JULY 1972 60 CENTS

Popular Science

THE What's New MAGAZINE

ADVANCED DRIVING SKILLS:
How to Cope with Trouble When You're Already In It

SNEAK PREVIEW OF '73 CARS
Year of the Bump-Proof Bumper

NOW THEY'RE BUILDING AIRPORTS
That Take the Hassle Out of Catching Your Plane

YOU CAN SEE IN THE DARK
with New Light-Amplifying Scopes

Come for a Ride on
BILL LEAR'S STEAM BUS

For Your Car, Boat, Camper—
CHOOSING AND USING A FIRE EXTINGUISHER

Sails Up!
WILD NEW WAY TO SURF

What You Can Do
WHEN YOUR CAR OVERHEATS

...25 other exciting articles, What's New Digest, 12 great monthly features

Copyrighted material

We're giving a new name to an old reliable.

And here's the case for it.

We used to call these cartridges Standard Velocity. But that didn't tell the whole story. Now, we call them "Target". And that tells you a lot more about their accuracy for short-range hunting, target practice and plinking.

Champion rifle tournament competitors use them in practice sessions to try to equal scores they achieved in previous shoots with our Rifle Match ammunition.

Along with a new name, we've put "Target" in a new 100 Pak. This specially designed plastic case keeps moisture and dust out, and the cartridges securely in place. You can dispense five or ten cartridges—or however many you need—at one time. No more fumbling with loose cartridges. And no more bulky packages. This one fits neatly in the pocket of a hunting shirt or jacket.

And when empty, the box has many uses: The ammunition tray makes an excellent loading block for the target shooter. The empty box itself is a great place to keep spare parts, nails, flies, screws or what-have-you.

And to make these empty boxes even more practical, we're offering a specially designed, tough plastic rack to keep them in. All our plastic 100 Pak boxes fit in the rack like drawers. When filled, the rack makes a handy utility cabinet that you can stack on a workbench or hang on the wall. To get your rack and an empty plastic 100 Pak box to get you started, send $1.25 and one label from *any* Remington or Peters 100 Pak 22 ammunition to: Remington Arms Company, Inc., Box 7400, Bridgeport, Connecticut 06602.

Remington® DU PONT PETERS®

Great guns deserve great ammunition. We make both.

Offer expires May 31, 1973.

"Remington" and "Peters" are trademarks registered in the U.S. Patent Office. "Target" is a trademark of the Remington Arms Company, Inc.

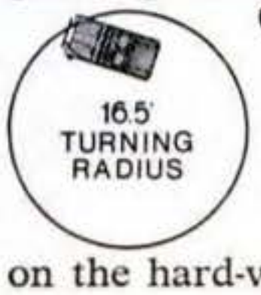
Copyrighted material

The Jeep®. It has a lot of pull in the right places.

It packs all the power you need, because it's got Jeep guts.

This baby is better than ever. And that's saying a lot, because the Jeep classic is the one people think of when it comes to multi-purpose 4-wheel drive vehicles.

To start with, open the hood. Inside are the biggest engines the Jeep has ever had. Powerful 6's. Or a mighty V-8. And look at the front axle. It's newly designed for greater maneuverability. Shortens the turning circle diameter by nearly six feet.



The steering mechanism is new on the hard-working Jeep, too. It requires less effort. And you can make it nearly effortless by adding power steering. And, naturally, you've got the world's most famous 4-wheel drive, so you go just about anyplace for the fun of it.

If you take your towing seriously, the Jeep offers such options as heavy-duty electrical and cooling systems, Trac-Lok differential, select drive front hubs and 4-speed transmission, to say nothing of trailer hitches.

Put it all together. See your Jeep dealer. It's the right place to pull off a great deal.

Toughest 4-le

This One

1B15-RKY-JK75

Drive your Jeep vehicle with care and keep America

Copyrighted material

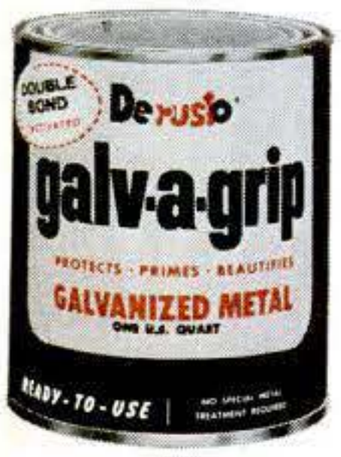
Stamp out repair problems with

the rust fixer

Prevents rust—stops rust. Derusto® Enamelized Spray by DAP. One coat primes, finishes and protects new or rusted metal surfaces. Push-button spray application. Comes in 24 beautiful decorator colors. For interior or exterior use.

the spouting fixer

Derusto® Galv-A-Grip by DAP. A special paint for galvanized and aluminum surfaces—gutters, downspouts, flashings—that grips tight. Won't peel, crack or chip like ordinary paint. Each coat primes and protects.



DAP®

DAP Inc., Dayton, Ohio 45401
Subsidiary of Plough, Inc.

Popular Science

REG. U.S. PAT. OFF. MONTHLY

THE What's New MAGAZINE™

JULY 1972 Founded in 1872/Vol. 201, No. 1

HIGHLIGHTS OF THIS ISSUE:

Advanced Driving Skills: How to Cope with Trouble When You're Already In It PAGE 50
Learn these maneuvers and you'll have a veteran's calm when danger looms.

Space Suits—from Pressurized Prison to Mini-Spacecraft PAGE 62
The fascinating story of the space suit's evolution from 1934 to Apollo 16.

Sails Up for a New Way to Surf PAGE 86
Wild! You don't need ocean waves for Windsurfing—just wind and water.

Build a Vacation Cluster PAGE 88
Each Microhut is an inexpensive, easy-to-move two-man shelter.

Overheating? How to Keep Your Cool PAGE 114
Here's how to troubleshoot and repair your own car's cooling system.

COVER PHOTO BY GM PHOTOGRAPHIC

What's New...

CARS AND DRIVING

Norbye/Dunne: Mini-Pickups—Zippy, Smart, Easy on Gas 26
Window Shade for Your Car 39
How to Cope with Trouble When You're Already In It 50
Bill Lear's New Steam Bus 54
Sneak Preview of '73 Models 82
New Fill-'er-Up Battery 84
Truth About Tire-Pressure Gauges 92
Overheating? How to Keep Your Cool 114

SCIENCE AND INVENTIONS

World's Largest Ship 53
13 New Gadgets from the 21st International Inventors' Show 60
Fantastic New Scopes Let You See in the Dark 66
New Quartz Watches: Liquid Crystals Tell the Time 79

SPACE AND AVIATION

Airports That Take the Hassle Out of Catching Your Plane 57
Space Suits—from Pressurized Prison to Mini-Spacecraft 62

PHOTOGRAPHY

New Polaroid Pops Out Color Prints in 1.3 Seconds 65

What's New DIGEST

A PICTURE ROUNDUP OF NEW PRODUCTS AND DEVELOPMENTS

Fly-Away Ejection Seat 70
No-Hands Phone 71
What's New in Tools 73
What's New in Electronics 74
What's New in Home Improvement 74
What's New for Your Car 75
What's New in Boating 76
What's New in Outdoor Recreation 77

HOME AND SHOP

Lazy Man's Light Switch 14
Set-Ups—Knockdown, Use-Again Cardboard Furniture 24
See-Through Kit Clock 37
Liven a Den with Hand-Hewn Beams 38
Mod 24: Good-Bye to 16-Inch O.C.? 69
For Pipe Smokers: Collector's Items You Carve Yourself 85
Build a Vacation Cluster 88
Amazing Sun Clock Tells Time Right to the Minute 100
This Tape Shrinks as It Seals 126

ELECTRONICS

Muse—Space-Age Music Box 15
Those New CB Radios 94
Foolproof Guard Keeps an Eye on Your Home 96

BOATING/OUTDOOR RECREATION

Three 250cc Cylinders—All the Power You'll Ever Need 78
Hot Showoffs—the Wild and Wet Way to Go 80
Sails Up for a New Way to Surf 86
Choosing a Fire Extinguisher 98
Faith Shoes 112
Jack Rack Lets You Truck a Bike 122

THE PS LOCKBOX HOUSE

Part III: Two Unique New Roofing Systems 102

EVERY MONTH

PS Readers Talk Back 8
Detroit Report 10
Recreation Roundup 12
New Ideas from the Inventors 16
"Say, Smokey—" 18
Science Newsfront 40
The View Down the Road 44
Look and Listen 46
PS: What's News 49
Taking Care of Your Car 106
Wordless Workshop 108
Shop Talk 120

Copyrighted material

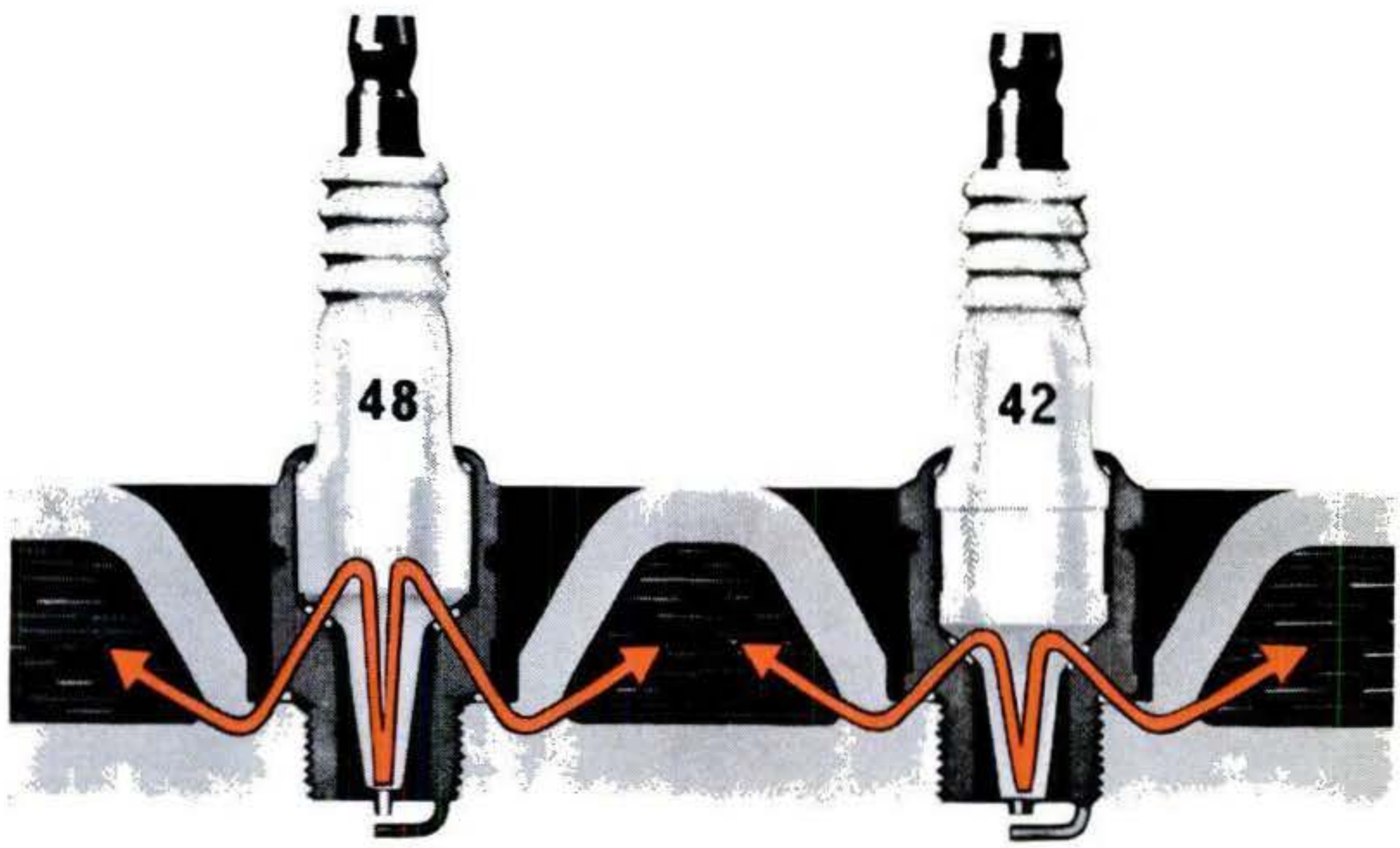
ASK THE AC ENGINEERS

"What is the difference between hot and cold spark plugs?"

The *rate* at which a spark plug dissipates heat determines whether it will run hot or cold.

This *rate* varies with the length of the lower part of the insulator as shown in the two AC Spark Plug cutaways below . . . and gives the spark plug its heat range index. The same spark plugs shown below represent two extremes in heat range design.

The second digit on each AC Spark Plug indicates its heat range and is read like a thermometer: The higher the number, the hotter the heat range.



The "hot" spark plug

The longer heat path in this high heat-range spark plug maintains a hotter operating temperature. Heat dissipation is slower, along the lower part of the ceramic insulator.

The "cold" spark plug

The shorter heat path in this low heat-range spark plug maintains a cooler operating temperature. Heat dissipation is quicker along the short lower ceramic insulator.

Why the difference? Engines operate at different combustion chamber temperatures under different driving conditions.

"Hot" spark plugs are used in extreme stop-and-go city driving. Combustion chamber temperatures are generally low and a "hotter" spark plug can help prevent fouling.

At sustained high speeds, combustion chamber temperatures are higher and a "cooler" spark plug can help prevent high-speed miss and damaging pre-ignition.

For the proper heat range for your car, consult your owner's manual.

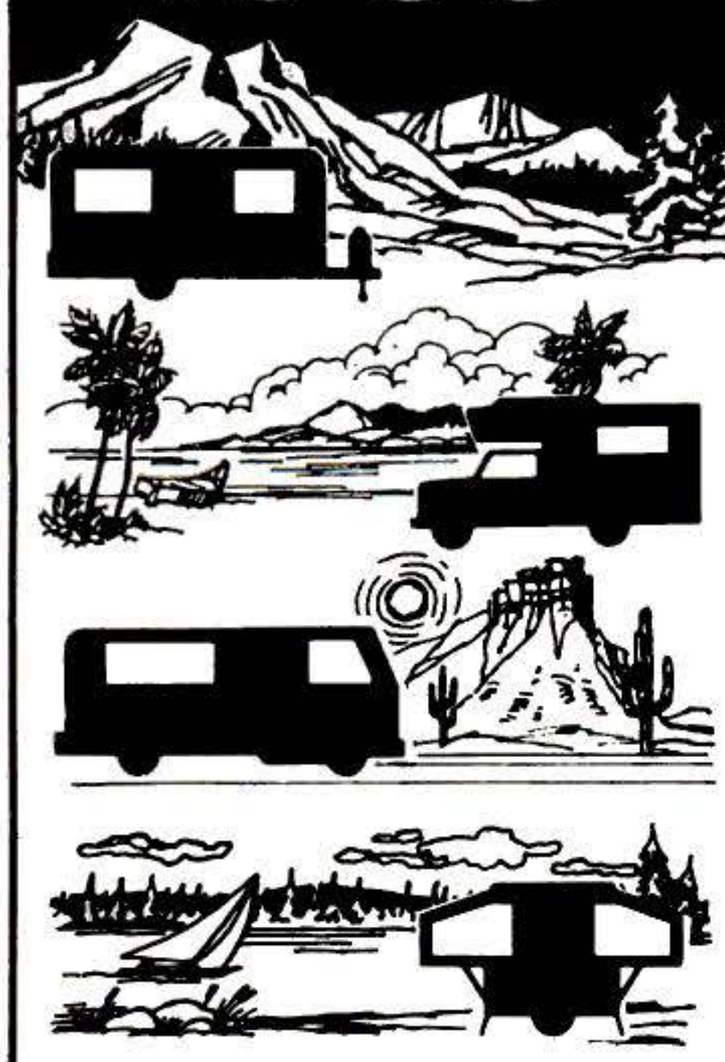
AC makes a complete range of spark plugs for every make and model. Hot, cold, or in-between, there's an AC ACniter Spark Plug that'll help give you top economy and performance. Whether you service your own car or have it done, next time ask for reliable ACs.

AC GM MARK OF EXCELLENCE

AC SPARK PLUG DIVISION

Copyrighted material

THE WAY TO GO*



FOR SAFETY AND EXTRA VALUE LOOK FOR THIS SEAL!

This seal is found only on recreational vehicles certified by the manufacturer as being *built to exacting standards* of safety. ANSI Standard A119.2 and National Electrical Code C1 cover plumbing, heating and electrical systems. RVI inspectors regularly check manufacturers to assist them in maintaining the high standards of safety represented by this seal.

You owe it to yourself — and your family ...try a recreational vehicle. Discover why millions of great friendly people say it's "The Way to Go!"

For information on recreational vehicle standards — mail this coupon today!

Name

Address

City State Zip

RECREATIONAL VEHICLE INSTITUTE

Dept. 72, O'Hare Office Center North
2720 S. Des Plaines Ave., Des Plaines, Ill. 60018

*The "WAY TO GO" is the title of a new RVI half hour color movie on recreational vehicling throughout the U.S.A. Write for full particulars.

What's New NEXT MONTH

Do-It-Yourself Guide to Home Security
Sailing the Little Cats: Fast, Foamy, Flippable
Handsome Hardboard Fun Dome You Can Build
New Style in Soaring—Self-Launched Sailplanes
6-Page Special Save-It Report:
Secrets of Keeping Your Clothes Dryer Trouble-Free

HUBERT P. LUCKETT
Editor-in-Chief

C. P. GILMORE, Executive Editor • KENDALL W. GOODWYN, Managing Editor
HARRY SAMUELS, Art Director • ROBERT P. STEVENSON, Director, Plans & Projects

GROUP EDITORS
ARTHUR FISHER, Science & Engineering • EVERETT H. ORTNER, Consumer Information
ALFRED W. LEES, Reader Activities

SENIOR EDITORS Herbert Shuldiner, David D. Vigren
AUTOMOTIVE EDITOR Jan P. Norbye • BOATING EDITOR Jim Roe
HOME WORKSHOP EDITOR A. J. Hand • ELECTRONICS EDITOR William J. Hawkins
ART EDITORS Herbert Anthony, Richard J. Meyer, W. David Houser
ART PRODUCTION MANAGER Henry W. Kazmirowski
ASSOCIATE EDITORS Ruth Westphal, John R. Free, Ray Hill
ASSISTANT EDITORS Kenneth Furie, Douglas Garr • MIDWEST EDITOR E. F. Lindsley
DETROIT EDITOR Jim Dunne • WEST COAST EDITOR Jim Davis • EUROPEAN EDITOR David Scott
EDITORIAL ASSISTANTS Anna Dallas (Chief), Marilyn Bender, F. B. Ford, Dorothy Fox, Susan Licato

CONSULTING EDITORS
DR. WERNHER VON BRAUN, Space • CMDR. SCOTT CARPENTER, Oceans
SMOKEY YUNICK, Auto Mechanics • KEN ISAACS, Design • JACKSON HAND, Home Improvement
ROBERT GANNON, Adventure • PHIL MCCAFFERTY, Projects • R. J. DE CRISTOFORO, Tools & Techniques
RICHARD DAY, Home & Shop • BEN KOCIVAR, Flying

E. S. DUFFIELD, President
J. MICHAEL HADLEY, Executive Vice-President and Publisher
ROBERT D. COLE, Vice-President and Circulation Director
PETER CALVO, Vice-President Production
FRANCIS X. WILKINSON, Vice-President and Advertising Director
STUART BERNARD, Vice-President Corporate Advertising Services
EDWARD F. HAGERTY JR., Business Manager

EDITORIAL OFFICES: 355 Lexington Ave., New York, N. Y. 10017
PUBLISHED MONTHLY by Popular Science Publishing Co., Inc.,
355 Lexington Ave., New York, N. Y. 10017

SUBSCRIPTION SERVICE

New or Renewal Orders: Send to: Popular Science Subscription Department, Boulder, Colorado 80302. One year $6, 2 years $11, 3 years $15 in U.S., its possessions, and Canada. Elsewhere, 1 year $9.50, 2 years $18, 3 years $25. Single copy 60¢ in U.S. and Canada.
Subscription orders processed electronically • **All subscription adjustments:** Write to Robert Harlan, Popular Science, P.O. Box 2871, Boulder, Colo. 80302. For change of address allow six weeks; please give both old and new addresses. Notices of undelivered copies (Form 3579) to Mr. Harlan. • **Second-class postage** paid at New York, N.Y., and at additional mailing offices. Entered as second-class matter at the Post Office Department, Canada. Printed in U.S.A.
Microfilm editions are available from University Microfilms, Ann Arbor, Mich. 48106.

ADVERTISING OFFICES

NEW YORK: 355 Lexington Ave. (10017), Tel. 212-687-3000; CHICAGO: 401 N. Michigan Ave. (60611), Tel. 312-527-0550; DETROIT: 1716 Fisher Building (48202), Tel. 313-872-7060; LOS ANGELES (Pacific West Coast): 3550 Wilshire Blvd., Suite 908 (90005), Tel. 213-380-1936.

Return postage must accompany all manuscripts submitted.
We cannot be responsible for the loss of manuscripts or photos.

Mechanics and Handicraft ® Popular Science ®

COPYRIGHT © 1972 BY POPULAR SCIENCE PUBLISHING CO., INC. ALL RIGHTS RESERVED

TO CHANGE YOUR ADDRESS

—or to enter a subscription at 1 yr. $6, 2 yrs. $11, or 3 yrs. $15, mail this form to Robert Harlan, POPULAR SCIENCE, P.O. Box 2871, Boulder, Colo. 80302.

ATTACH LABEL HERE

Are You Moving Soon?

If you are planning to move, please notify us 6 weeks in advance and we'll make sure your subscription moves with you. Please use this form and attach your magazine address label.

Name

New Address

City State Zip Code

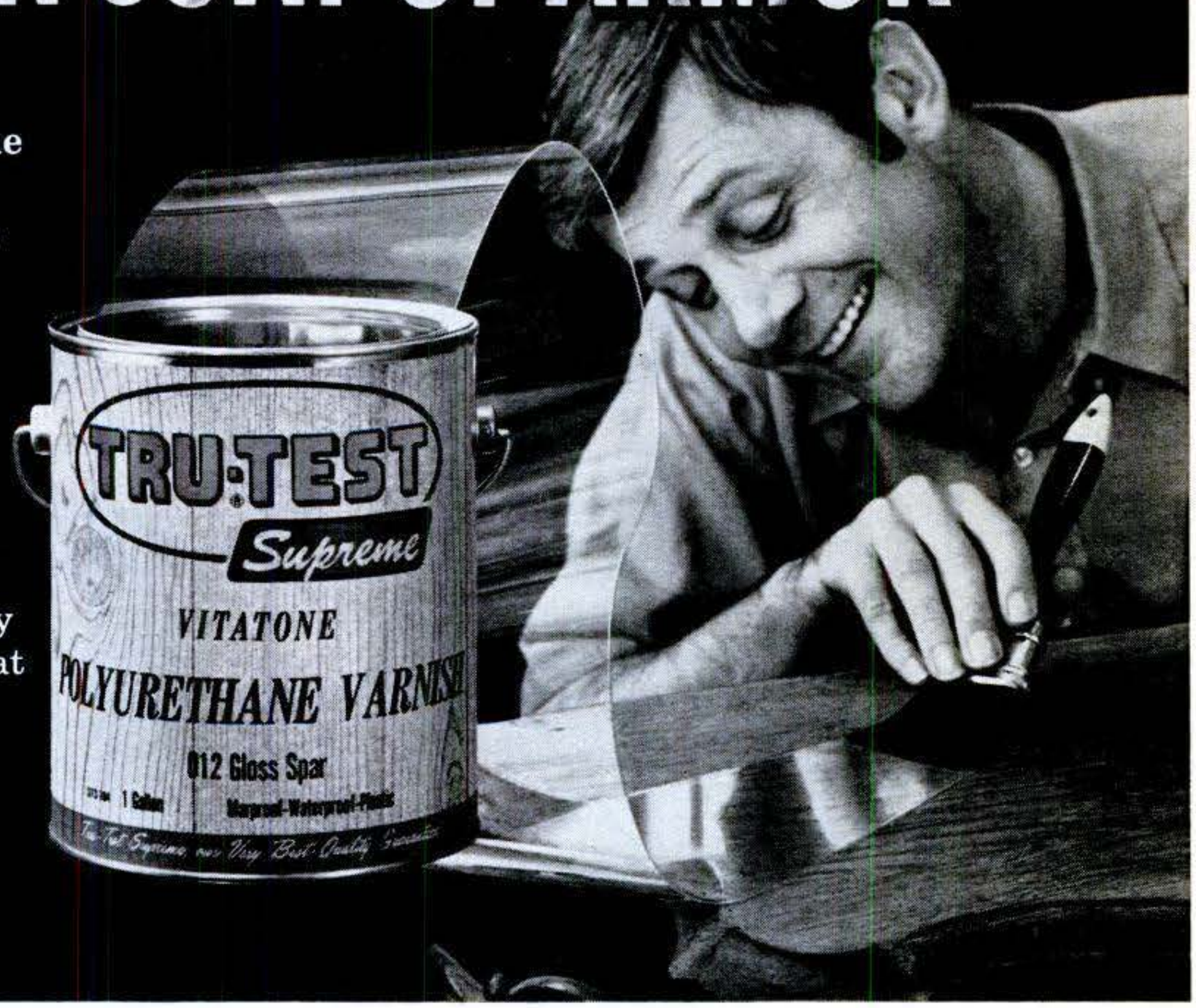
Moving Date

PRINTED IN U.S.A.

Copyrighted material

New kind of finish beauty–treats any wood with a "CLEAR COAT OF ARMOR"

Tru-Test Polyurethane Finish gives a rich new look of luxury to tables, desktops, doors, baseboards, floors, serving bars—anything wood, new or old, inside or outside. Tough plastic finish is crystal clear. Won't chip, crack, mar or peel—protects up to twice as long as ordinary varnish. Self-leveling coat flows on smoothly with paint brush, dries surprisingly fast. Choice of high-gloss, satin, dull finishes.



Tru-Test Paints sold only by True Value Hardware Dealers who own their own paint factory. For one near you look under "Paint" in the classified phone directory.

Yellow Pages

Fresh new beauty? Powerful, long-lasting protection? Easy with The Rust Buster.

New formula X-O Rust gives tools, toys, ironwork, lawn furniture, rain gutters, anything metal a "like new again" appearance. One coat keeps ruinous rust from spreading on old surfaces, never lets it start on new galvanized metals. Excellent adhesion on masonite, wood, concrete. No thinning, comes ready to use in 17 colors. Pint **1.65**; Quart **2.69**; spray can, 16-oz. **1.79**.

True Value®
HARDWARE STORES

COTTER & COMPANY • 100% DEALER-OWNED
GENERAL OFFICES CHICAGO, ILLINOIS 60614

Copyrighted material

FREE...5 Stereo LPs or

Worth up to $32.90

2783 B. J. THOMAS
Billy Joe
Scepter

6884 THE LONDON CHUCK BERRY SESSIONS
Chess

6164 JOHNNY WINTER
First Winter
Buddah

7044 BEETHOVEN
Piano Sonatas
Yorkshire

5547 MOODY BLUES
In Search Of The Lost Chord
Deram

***3700 JAMES TAYLOR**
& The Flying Machine
Euphoria

9114 OSMONDS
Phase III
MGM

2640 GUESS WHO
Born In Canada
Wand

5503 ENGELBERT HUMPERDINCK
Live At The Riviera
Parrot

1037 STEPPENWOLF
Gold
ABC/Dunhill

8281 ROGER WILLIAMS
Summer Of '42
Kapp

6147 SHA NA NA
Kama Sutra

3170 BUFFY SAINTE-MARIE Moonshot
Vanguard

0522 WOODSTOCK TWO
(2 LPs & 2 tapes)
Cotillion

7000 TCHAIKOVSKY
1812 Overture
Yorkshire

7269 ENVIRONMENTAL SOUNDS Nature's Music
Yorkshire

5577 ANNUNZIO PAOLO MANTOVANI
London

6870 THE SOUL OF ARETHA FRANKLIN
Checker

1196 GRASS ROOTS
Their 16 Greatest Hits
ABC/Dunhill

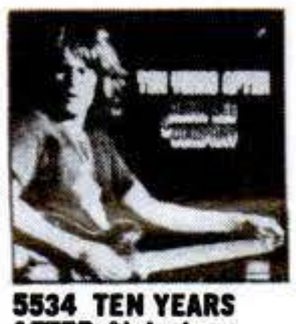
0286 DIONNE WARWICKE From Within
(2 LPs & 2 tapes)
Scepter

0802 TOM JONES
Live At Caesars Palace
(2 LPs & 2 tapes)
Parrot

9058 2001: A Space Odyssey
MGM

8178 THE WHO
Who's Next
Decca

***7802 MOUNTAIN**
Flowers Of Evil
Windfall



5534 TEN YEARS AFTER Alvin Lee & Co.
Deram

2059 ROD STEWART
Every Picture Tells A Story
Mercury

0371 GREATEST FOLK SINGERS OF THE SIXTIES
(2 LPs & 2 tapes)
Vanguard

***NOTE: 8-track and cassette tapes NOT available for these selections only**

Compare and see!

See why 3,500,000 Record and Tape Buyers Paid $5 to Join RECORD CLUB OF AMERICA when Other Clubs Would Have Accepted Them FREE!

	CAN YOU CHOOSE FROM ALL LABELS?	CAN YOU PICK LPs AND TAPES, INCLUDING CARTRIDGE AND CASSETTE TAPES?	MUST YOU BUY A "MINIMUM" NUMBER OF LPs OR TAPES? HOW MANY?	HOW MUCH MUST YOU SPEND TO FULFILL YOUR LEGAL OBLIGATION?	CAN YOU BUY ANY LP OR TAPE YOU WANT AT A DISCOUNT?	DO YOU EVER RECEIVE UNORDERED LPs OR TAPES?	HOW LONG MUST YOU WAIT FOR SELECTIONS TO ARRIVE?	DO YOU GET FREE RECORDINGS FOR SIGNING UP YOUR FRIENDS—WITH NO OBLIGATION TO YOU OR YOUR FRIENDS?	CAN YOU GET FREE OR BONUS RECORDINGS WITH EVERY MAILING?	CAN YOU GET BESTSELLING BOOKS, POSTERS AND STEREO COMPONENTS AT BIG DISCOUNTS?
Columbia Record Club (as advertised in American Girl Mar '72)	NO	NO	10	$58.05 to $78.05	NO	YES	5 to 6 weeks	NO	NO	NO
Columbia Tape Club (as advertised in Stereo Review Mar '72)	NO	NO	7	$56.06 to $63.06	NO	YES	5 to 6 weeks	NO	NO	NO
RCA Record Club (as advertised in Reader's Digest Jan '71)	NO	NO	6	$40.78 to $52.68	NO	YES	5 to 6 weeks	NO	NO	NO
RCA Tape Club (as advertised in Reader's Digest Jan. '71)	NO	NO	6	$52.68 to $58.68	NO	YES	5 to 6 weeks	NO	NO	NO
Capitol Record Club (as advertised in Playboy Dec '71)	NO	NO	12	$70.03 to $94.03	NO	YES	5 to 6 weeks	NO	NO	NO
Capitol Stereo Tape Club (as advertised in Playboy May '72)	NO	NO	10	$77.62 to $87.62	NO	YES	5 to 6 weeks	NO	NO	NO
Citadel Record Club (as advertised in Esquire Feb '72)	NO	NO	12	$56.25 to $74.25	NO	YES	5 to 6 weeks	NO	NO	NO
RECORD CLUB OF AMERICA	**YES!** Choose recordings on any label. No exceptions! Over 300 different manufacturers including Capitol, Columbia, RCA, Angel, London, etc.	**YES!** Pick LPs OR 8-track tape cartridges OR tape cassettes. No restrictions. No additional membership fee or separate "division" to join!	**NONE!** No obligations! No yearly quota! Take as many, as few, or nothing at all if you so decide.	**ZERO DOLLARS** You don't have to spend a penny—because you're not "legally obligated" to buy even a single record or tape!	**ALWAYS!** Guaranteed discounts up to 81% on LPs and tapes of ALL LABELS!	**NEVER!** There are no cards which you must return. Only the records and tapes you want are sent—and only when you ask us to send them.	**NO LONG WAITS!** Your order processed same day received. No shipping on cycle.	**YES!** Share 5 FREE LPs or 3 FREE Tapes with every friend who joins—and neither you nor he need buy anything ever!	**YES!** The instant you join we offer you many more FREE or BONUS LPs and tapes for modest minimum purchase as small as 1 discounted LP. NEW FREE or BONUS offer every 21 days!	**YES!** You get money-saving Discount Brochures and Catalogs the moment you join. PLUS FREE SUBSCRIPTION to the AMAREHOUSE™ the Club's revolutionary new mail order bag of hip products.

RECORD CLUB OF AMERICA—The World's Largest Record and Tape Club

Copyrighted material

3 Tapes with NO OBLIGATION
TO BUY ANYTHING EVER!

Yes, take your pick of these great hits right now! Choose any 5 Stereo LPs (worth up to $32.90) or any 3 Stereo Tapes (cartridge or cassette, worth up to $23.94) FREE . . . as your welcome gift from Record Club of America when you join at the low lifetime membership fee of $5.00. You can defer your selection of FREE items and choose from an expanded list later if you can't find 5 LPs or 3 Tapes here. We make this amazing offer to introduce you to the only record and tape club offering guaranteed discounts of up to 81% on all labels—with no obligation or commitment to buy anything ever. As a member of this one-of-a-kind club you will be able to order any record or tape commercially available, on every label—including all musical preferences. No automatic shipments, no cards to return. We ship only what you order. Money back guarantee if not satisfied.

4275 DON MC LEAN
American Pie
United Artists

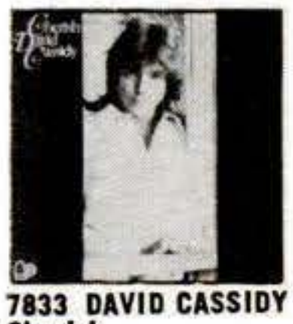
7859 PARTRIDGE FAMILY SHOPPING BAG
Bell

5171 YES
Fragile
Atlantic

1377 JAMES GANG
Straight Shooter
ABC

5198 ROBERTA FLACK
First Take
Atlantic

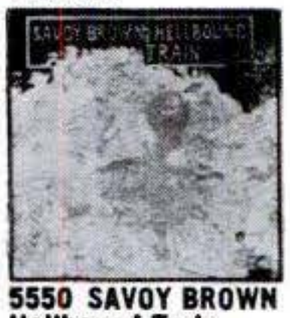
1433 GRASS ROOTS
Move Along
ABC/Dunhill



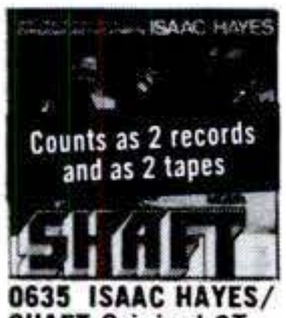
7833 DAVID CASSIDY
Cherish
Bell

7846 5TH DIMENSION
Individually & Collectively
Bell

0354 JOAN BAEZ
Blessed Are . . .
(2 LPs & 2 tapes)
Vanguard



5550 SAVOY BROWN
Hellbound Train
Parrot



0635 ISAAC HAYES/
SHAFT Original ST
(2 LPs & 2 tapes)
Enterprise

5138 LED ZEPPELIN
Atlantic

6431 STAPLE SINGERS
Be Altitude:
Respect Yourself
Stax

5206 CREAM
Live, Vol. II
Atco

1183 THREE DOG NIGHT
Harmony
ABC/Dunhill

2779 B. J. THOMAS
Greatest Hits Vol. Two
Scepter

0505 CROSBY, STILLS, NASH & YOUNG
Four Way Street
(2 LPs & 2 tapes)
Atlantic

7863 MICHEL LEGRAND
Brian's Song
Bell

7777 GODSPELL
Original Cast
Bell

0272 DIONNE WARWICKE STORY
(2 LPs & 2 tapes)
Scepter

6150 BREWER & SHIPLEY Shake Off
The Demon
Kama Sutra

1235 STEPPENWOLF
For Ladies Only
ABC/Dunhill

3860 HILLSIDE SINGERS
I'd Like To Teach
The World To Sing
Metromedia

AT LAST A RECORD AND TAPE CLUB WITH NO "OBLIGATIONS"—ONLY BENEFITS!

Ordinary record and tape clubs make you choose from a few labels—usually their own! They make you buy up to 12 records or tapes a year—usually at List Price—to fulfill your obligation. And if you forget to return their monthly cards (which can cost an additional $2.40 in postage!)—**they send you an item you don't want** and a bill for $4.98, $5.98, $6.98 or $7.98! In effect, you may be charged almost double for your records and tapes. **We send only what you order!**

GET LPs ON ALL LABELS FOR AN AVERAGE OF $2.39 EACH!

We're the World's Largest ALL-LABEL Record and Tape Club, so you get the LOWEST EXISTING PRICES on all records and tapes made, **and guaranteed discounts of up to 81%.** A current Club Sale offers hundreds of top hit $5.98 LPs of ALL LABELS at an average price of only $1.99—you save an average of $4.99 per LP! Yes, and save an average of $4.30 on top hit $6.98 tape cassettes and cartridges too. Start these giant savings now...not after you fulfill your obligation like other clubs.

TOP STEREO EQUIPMENT BARGAINS TOO!

The moment you join, you'll start receiving Discount Hi-Fi Catalogs, offering top brand name stereo equipment at drastically reduced prices—PLUS many FREE LPs and tapes for your purchases!

HOW CAN WE BREAK ALL RECORD AND TAPE CLUB RULES?

We are the ony major record and tape club NOT OWNED...NOT CONTROLLED...NOT SUBSIDIZED by any record or tape manufacturer anywhere. Therefore, we are not obliged by company policy to push any one label. Nor are we prevented by distribution commitments from offering the very newest LPs and tapes.

SPECIAL INTRODUCTORY MEMBERSHIP OFFER

Join Record Club of America now and take any 5 LPs or any 3 tapes shown here (worth up to $32.90) and mail coupon with check or money order for $5 membership fee (a small mailing and handling fee for your free LPs or tapes will be sent later). **If you can't find 5 LPs or 3 tapes here, you can defer your selection and choose from expanded list later.** You receive LIFETIME MEMBERSHIP—and you never pay another Club fee. Your savings have already more than made up for the nominal membership fee.

NOW YOU CAN CHARGE IT

If you prefer, you may charge your membership to one of your credit cards. We honor four different plans. Check your preference and fill-in your account number on the coupon.

LOOK WHAT YOU GET

- **FREE Lifetime Membership Card** — guarantees you brand new LPs and tapes at discounts up to 81%.
- **FREE Giant Master LP and Tape Catalog**—lists thousands of all readily available LPs and tapes (cartridges and cassettes) of **all labels** (including foreign) . . . **all musical categories.**
- **FREE Disc and Tape Guide** — The Club's own Magazine, and special Club sale announcements which regularly bring you news of just-issued new releases and "extra discount" specials.
- **FREE ANY 5 Stereo LPs or any 3 Tapes** shown here (worth up to $32.90) with absolutely no obligation to buy anything ever!
- **FREE Subscription to the WAREHOUSE™**—colorful catalog of hip products, more FREE LPs and tapes.

GUARANTEED INSTANT SERVICE

All LPs and tapes ordered by members are shipped same day received (orders from the Master Catalog may take a few days longer). ALL RECORDS AND TAPES GUARANTEED factory new and completely satisfactory or replacements will be made without question.

MONEY BACK GUARANTEE

If you aren't absolutely delighted with our discounts (up to 81%)—return items within 10 days and membership fee will be returned AT ONCE! Join over three million budget-wise record and tape collectors now.

© 1972 RECORD CLUB OF AMERICA #89

RECORD CLUB OF AMERICA
CLUB HEADQUARTERS
YORK, PENNSYLVANIA 17405 **V052D**

Yes—Rush me a lifetime Membership Card, Free Giant Master LP & Tape Catalog, and Disc & Tape Guide at this Special Membership Offer. Also send me the 5 FREE LPs or 3 FREE tapes which I have indicated below (with a bill for a small mailing and handling charge). I enclose my $5.00 lifetime membership fee. This entitles me to buy any LPs or tapes at discounts up to 81%, plus a small mailing and handling charge. I am not obligated to buy any records or tapes—no yearly quota. If not completely delighted I may return items above within 10 days for immediate refund of membership fee.

5 FREE LPs

☐ ☐ ☐ ☐ ☐

or 3 FREE TAPES Ω

☐ ☐ ☐ ☐ 8 track ☐ cassette

or ☐ **Defer Selection**—send expanded list.

Mr.
Mrs.
Miss _____

Address _____

City State Zip

All Servicemen write Soc. Sec. #_____

CHARGE IT to my credit card. I am charging my $5.00 membership (mailing and handling fee for each FREE LP and tape selected will be added).

Check one: ☐ **Master Charge** ☐ **American Express** ☐ **BankAmericard** ☐ **Diners Club**

Acct #_____

Signature_____ Expiration Date_____

CANADIANS mail coupon to above address. Orders will be serviced in Canada by Record Club of Canada. Prices vary slightly.

RECORD CLUB OF AMERICA—The World's Lowest Priced Record and Tape Club

Copyrighted material

6½ lb.*
People Size
saw

fells trees
2 ft. thick

The Pony chain saw is big enough and rugged enough to do any man-size job. Trim trees. Cut brush. Saw firewood. Build furniture, too, And small enough to go anywhere. Instant fingertip starting. 12" cutting blade. Full automatic oiling. Fully warranted. It's the must "see" saw. Small price. Big value.
Five other Lombard chain saws; from the "full size" 4.2 cubic-inch Comango, to the Super Lightning Anti-Vibe, the "pro-designed" vibration-free power model.
Trot or gallop over to your nearest Lombard dealer and put your brand on our Pony.

*6 lb. 7 oz. without bar and chain

SUPER LIGHTNING Anti-Vibe

LOMBARD
POWER EQUIPMENT
4181 Rocky River Drive,
Cleveland, Ohio 44135
Available throughout Canada.

PS Readers Talk Back

Where you voice your views . . . and the editors do the listening

Dr. Commoner and the environment

While Dr. Barry Commoner's credentials are "impeccable," his article "A Healthy Environment . . ." [May] is a polemic rather than an objective appraisal of technology. Apparently, his environmental fanaticism and longing for the good old days (does he buy tires with cotton cord and wear long wool undies?) has blinded him to the obvious fact that the environment is a long way from being overloaded, except in certain areas of human concentration.

For example, Dr. Commoner states, "The modern high-compression gasoline engine . . . causes oxygen and nitrogen in the air to combine as nitrogen oxides, substances otherwise rare in nature . . ." This is absolutely true, but the concluding clause is not: "and not readily accommodated by natural environmental processes." Any gardener knows that a principal element in chemical fertilizer

is nitrogen and that the effect of high nitrogen is to make grass grow greener.

ROSS F. FIRESTONE, Pittsburgh, Pa.

A letter from Joseph Weber

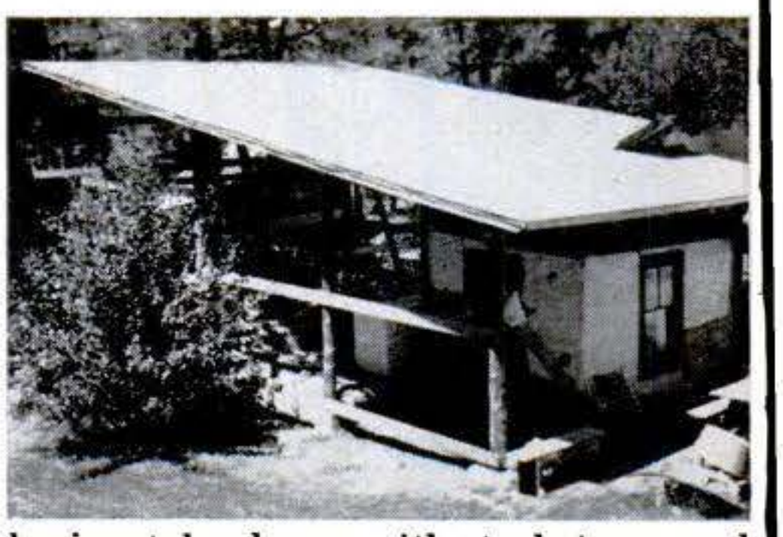
This concerns my article, "How I Discovered Gravitational Waves" [May]. The editors altered the article considerably and most of the changes were known to me and approved before publication.

However, I was unaware that the title was to be changed from the one I submitted: "Experiments in Gravitational Radiation." I was also unaware that the editors would publish photographs other than the ones I submitted.

J. WEBER, Professor of Physics
U. of Maryland, College Park, Md.

Lockbox look-alike

It was interesting to see POPULAR SCIENCE publish its description of the Lockbox House with a "truly innovative design" similar to the one my husband and I carried out when we needed to add four bedrooms, a bath, and a utility room to our already existing too-small house. Enclosed is a snapshot showing the roof supported by pole and frame. The trickiest part of our addition was putting horizontal poles across the vertical poles to support the roof rafters. We held the



horizontal poles on with steel straps and bolts. The toughest part of the new roof was drilling hundreds of holes with a hand brace and bit. Two-inch rough lumber is no light wood to work with.

Our house blends in well with the environment of ponderosa pine and is admired by all who see it.

MRS. J. GAVAHAN, Montezuma, N.M.

. . . Read with interest about the Lockbox in the May issue. But, being an avid sportsman and hunter, I must protest the use of the word "hunters" in the same sentence and context as pilferers and vandals.

JAMES S. FRANCIS, Grandview, Mo.

Author Lees replies: "Alas, a growing number of vacation-home break-ins—especially in remote areas during winter months—are laid to hunters (not sportsmen like yourself) who oddly assume a right to help themselves to shelter and food. Except in emergencies, such hunters are pilferers and vandals, and our Lockbox bids them no welcome."

Citröen: car of the future?

After reading "A Look at the Car of the Future" [May], it occurred to me that nearly every one of the desirable features in the car (actually the best features of five cars) was available in the Citroën DS-21 and at a price in the middle: $4,000 to $6,000. The only feature not now available is the rotary engine, and Citroën is currently testing this under actual use by the public.

OWEN LIBBY JR., W. Palm Beach, Fla.

. . . I enjoyed reading about the car of the future, but I think that car has been here since 1956. That year, Citroën introduced the DS-19 with a hydraulic suspension system and front-wheel drive; the latter they've been making since the 1930s. All the D-series Citroëns have self-leveling headlights and they turn with the front tires. How about a report on the DS-21 or the D Special?

CHUCK DALEY, Columbus, Mo.

Norbye and Dunne tested both the Citroën DS-21 and the D Special—see PS, Aug. '70 and Dec. '71.

Will the dome burn?

You are endangering your readers' lives unless you correct an error that author Richard Day ["The Great Dome Boom Is On," Feb.] repeated in a reply to a PS Readers Talk Back letter

Copyrighted material

[Apr.]. Day reversed his samples of polyurethane and polystyrene and is declaring the unsafe one to be the safest. Polyurethane is fire-resistant; polystyrene burns and burns.

To prove it to you and to him we are unveiling a revolutionary dome and will douse the polyurethane with gas and ignite it. I hope Mr. Day can be there.

ALLEN DAVIDSON, President
Geodesic Dome Co., Hollywood, Calif.

Day replies again: "I'll be there with a match. Dow Chemical, which makes some of the best plastic foams, termed the test 'instant suicide.' All plastic foams—polystyrene as well as urethane—will burn if they get hot enough. The good ones contain fire-retardant chemicals to render them 'self-extinguishing.' That is, they'll burn as long as you hold a match to them, then go out. There is a difference in the way the two foams react to flame. Most urethane foams are thermosetting—they stiffen when heated. Urethane hangs in and chars or burns. Polystyrene is thermoplastic. When exposed to flame, it melts away in hot, nonburning globs."

PS on microfiche

I think if it were at all possible you should publish a price list for those who would like to buy back issues of POPULAR SCIENCE on microfiche cards. After all, you've published two articles on the subject [Feb. and May].

BILLY BYRD, Gambrills, Md.

PS has been available on microfiche since January 1970. For more information write University Microfilms, Ann Arbor, Mich. 48106.

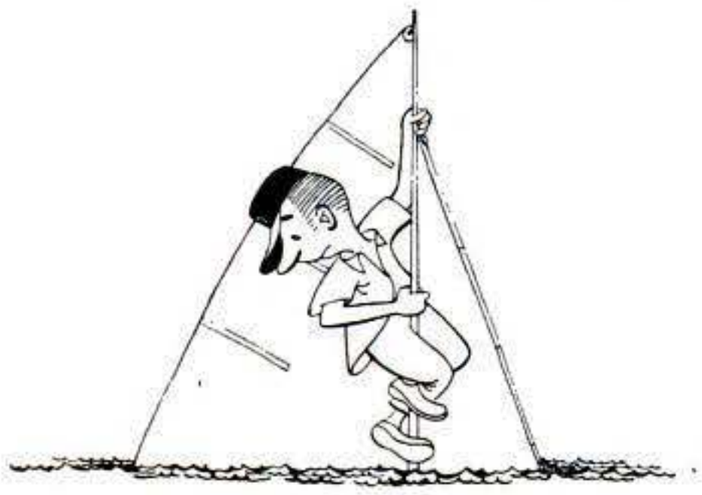
$$$ and domes

I enjoyed reading Buckminster Fuller's "My New Hexa-Pent Dome" [May] but he didn't mention one drawback: Bankers and other loan agencies have a tendency to frown on what they call "nonconventional" homes when it comes to financing.

CLARENCE GILLISPIE, Branch, Mich.

Glue for the Pumpkin Seed

In "Fast New Sailboat You Can Build" [May], you recommend using a white glue in the construction of the Pumpkin Seed. Nobody should use a

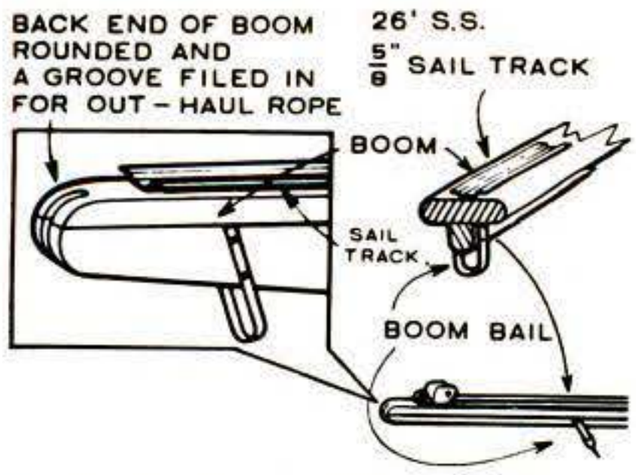


white glue on a boat unless they never intend to put it in the water.

ALLEN WEISS, Jamaica, N.Y.

White glue is fine. As the article states, the hull should be fiberglassed—which should keep any water from weakening a white-glue bond.

. . . In Part II of the Pumpkin Seed sailboat story [June] the drawing shows the aft end of the boom, but it points to the front or gooseneck end. This may be



confusing to some of the builders. The drawing should look like this.

JACK PAYNE, Franklin Lakes, N.J.

GM's rotary-engine Vega

My enthusiasm was racing as I read in the 100th Anniversary Issue about the '74 Vega's new rotary engine. It dropped a few thousand rpm, however, when I hit the part about the price. Why even worry about saving $5 on ignition parts when you're going to slap an extra thousand bucks on the price because of "extra power." So seals that last 400,000 to 500,000 miles are "too good." Nothing's too good for an economy car with that kind of tag. I'll buy a Japanese import before subsidizing so blatant a form of corporate robbery.

WALT TAYLOR, Quakertown, Pa.

. . . You say, "You have always expected to pay more for extra power." What you mean is that General Motors is going to exploit the consumer to the maximum extent possible.

DENNIS HANGEN, Tampa, Fla.

. . . Mr. Dunne mentions that, by eliminating two spark plugs, a coil, and a distributor on the Vega, GM will have saved almost $5 per engine. Now if I walked into the local auto-parts store, plunked down a five spot, and walked out with those parts, I would immediately become a candidate for the "Good Morning, Judge" column.

M. B. CAUDLE, Shelburn, Ind.

From the White House

This is to express my thanks for your kindness in sending me the May issue of POPULAR SCIENCE. I was pleased to hear from you and to receive this specially prepared copy of your magazine, marking the 100th anniversary of its publication, and note with interest the editorial comment and feature article on earlier-day events.

May I take this opportunity to extend my congratulations on this historic milestone you are observing and to wish you and your associates continued success in your future endeavors.

RICHARD NIXON, Washington, D.C.

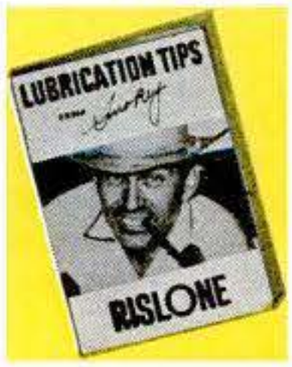
PS thanks the President and all our readers who took time to send us a note wishing us a "happy birthday."

Want to get something off your chest?
Write "Readers Talk Back,"
Popular Science, 355 Lexington Ave.,
New York, N.Y. 10017.

ANTI-POLLUTION ENGINES ARE TOUGH ON VALVES

RISLONE IS THE ORIGINAL VALVE TREATMENT.

Test Drive it!



FREE Get some hints from a REAL engine expert, Smokey Yunick. Send large, self-addressed, stamped envelope and we will send 32-page booklet.

THE SHALER CO.
Waupun, Wisconsin 53963
In Canada: Canadian Shaler Products Co., Ontario

Copyrighted material

Detroit Report...

By JIM DUNNE / *PS Detroit Editor*

Dash control sets handling the way you want it

Soon you will be able to dial your own handling preference into your car. Volkswagen research engineers have a device that lets you change the handling of your car while you drive. Called Copilot, it will switch your car from oversteer, to understeer, to neutral steer with the switch of a dial. It works like this: A special gear drive, installed in the steering system, overrides the driver's steering motion. Front wheels are turned more (or less) than the driver cranks into the steering wheel. The revolutionary system includes an accelerometer, speed-sensing unit, steering-wheel angle sensor, and control unit. Tested on a rear-engine Porsche, the unit can instantly change this car into a severe understeer mode. The system is unaffected, up to a point, by tire pressures, types of tires used, and road surfaces. It is expected to prove most useful on cars with uneven weight distribution and large variations in load.

Wankel engines cheaper? Not yet!

One by one, Wankel engine problems are being licked. Engine seals have long been a question mark, but a number of makers, including GM and NSU, say they have seals now that will last hundreds of thousands of miles. Some drawbacks remain. Cost is higher than for a four-cylinder piston engine, despite claims that the Wankel should cost less to produce. Mazda sells its Wankel-powered car for hundreds of dollars more than the same car equipped with a piston engine, and GM is having problems making its rotary cheaper than the four-cylinder Vega engine.

Bear in mind that the Mazda rotary is over-engineered for reliability. It's also produced in fairly modest quantity: about 24,000 units a month. At NSU, they're aggressively cutting costs in a program that will shave money out of the Ro80 engine. Depending on who you listen to, the Ro80 costs 1.2 to 1.5 times as much as a comparable four-cylinder air-cooled NSU engine. NSU makes 8,000 to 10,000 Wankels monthly.

Fuel economy is also a problem. Reports are commonly heard that the Wankel uses up to 25 percent more fuel than a small piston engine, but progress appears here too, if only because the piston engine becomes less efficient as smog controls are added.

Second-generation Blazer

Along with its new pickup truck, Chevy will have a redesigned Blazer utility for 1973. The vehicles use a common cab, which will be all new. Chevy will make it easier to tell the two apart by putting a special grille on the Blazer, without the traditional eggcrate design. Blazer will also have as a '73 option: full-time four-wheel drive, made by Chrysler's New Process Division. The drive unit will be the first of its kind on the market, forerunner of a whole passel of full-time systems. In the pickup, Chevy will market a dual-rear-wheel camper series which will provide a more stable base for mounting camper bodies. It has less lean on turns, and is husky enough to handle the biggest camper bodies.

Cadillac engines for Buick and Olds?

GM has made the first move in a program that may eventually place all engine production under control of Chevrolet and Cadillac. When the program is completed, Olds, Buick, and Pontiac may not make their own engines, but will be supplied from Chevy and Cadillac. First move was the opening of a new Cadillac engine-block and components factory near Detroit. A new machining line there can turn out more than 1,000,000 engines a year at full production—far beyond Cadillac requirements. Later, both Chevy and Cadillac may open other facilities to supplant engine production at the other car divisions.

Keeping up with the bumpers

Many unseen changes have been made in '73 models to meet the new five-mph bumper standards. At Chrysler a new spool-type engine mount is used on intermediates and compacts. The spool mounts limit fore-and-aft motions of the engine during low-speed impacts, stop the engine fan from hitting the radiator. In addition, engine roll is limited to 2.5 degrees. The Chrysler bumpers are placed about three inches farther out from the body on 1973 full size, intermediate, and specialty cars, with a vinyl filler in the gap between bumper and car body. All Chrysler bumpers are equipped with large, solid-rubber guards from three to four inches thick. These guards can be compressed up to 60 percent in crashes, enough to absorb substantial impact loads.

Special new Wankel oils

New motor oils that will probably cost less are being developed for the Wankel engine by oil companies both in the U.S. and Europe. Right now all Wankel-engine cars use the standard motor oil recommended for piston engines. The new motor oils, formulated specially for the Wankel, will have different additives to suit the special requirements of the rotary engine. In Europe, Fina has announced its own rotary-engine motor oil. In the U.S., oil companies are researching the needs of the Wankel engine to find out which additives now used in oils should be retained.

Insiders say the less-demanding work that oil does in the rotary engine will permit oil companies to eliminate some additives, sell the new oil at a lower price. Since the Ro80 uses a common sump for its rotary engine and torque converter, NSU recommends standard motor oil for it. Using standard oil in the converter results in a three percent loss in efficiency compared with transmission fluid, says NSU.

Inboard-mounted front disks for future GM cars

GM's front-wheel drive '75 Wankel-powered cars will have inboard instead of hub-mounted brakes for the front wheels, the first time such a design has been used on U.S. cars in modern history. Benefits of the inboard design are better brake cooling—and reduced unsprung weight, which means higher steering precision. The brakes will be attached to the front drive shafts at the end nearest the transaxle. For the auto maker, inboard brakes represent a cost saving. Calipers can be built right into the differential case instead of being made separately.

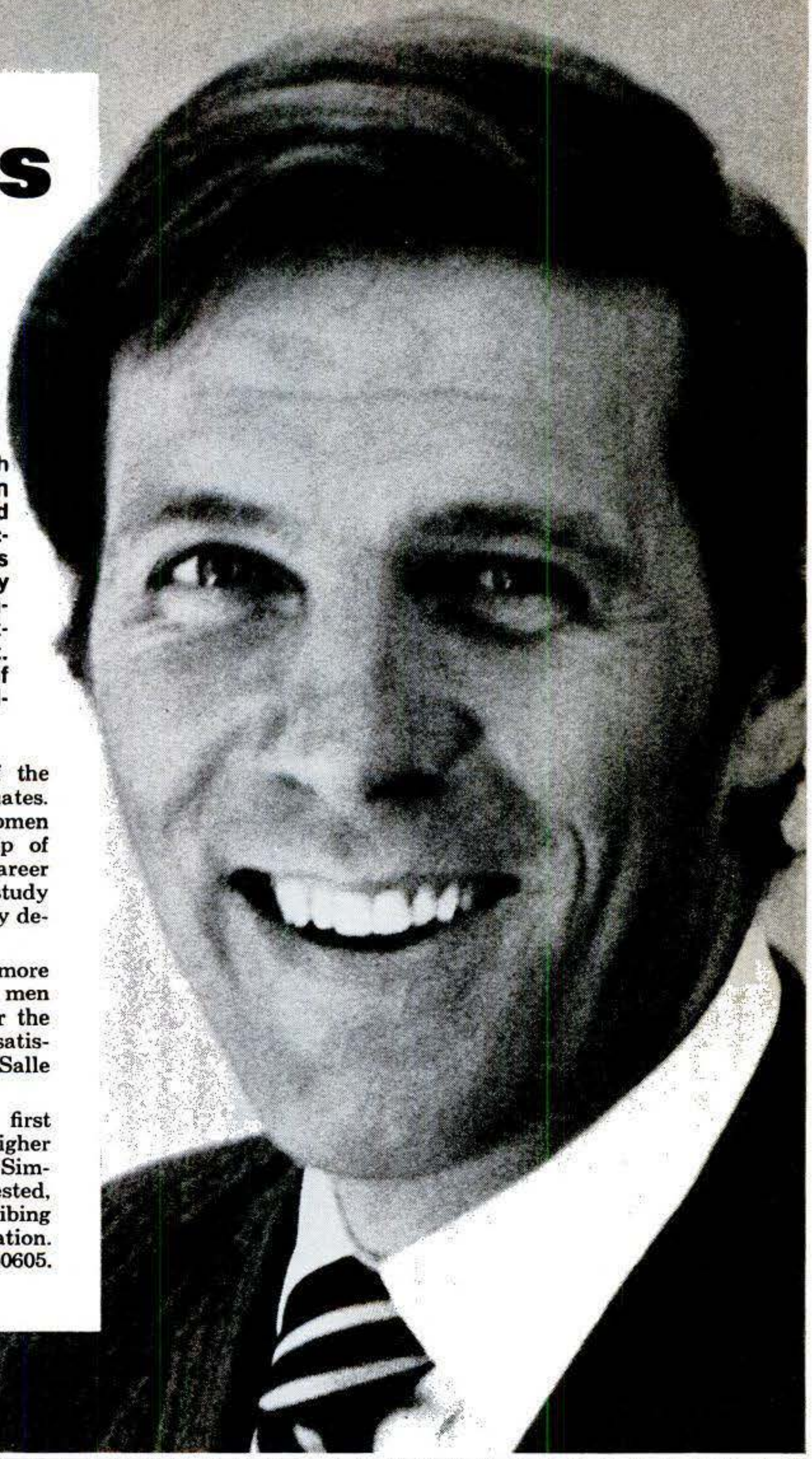
American Motors—what's going on?

After several years of declining sales, AM is making a strong comeback, and has scheduled changes in its 1974 cars that will make the company more competitive. Big-car lines —Matador and Ambassador—will get all-new sheet metal, new grilles, and new interiors. The other series will have facelift changes. Javelin's still a question. Some sources say the car will be dropped from AM's lineup—slow sales in the sporty compact class is given as the reason. Others say the car will be a special model in the Hornet series.

AM's Buyer Protection Plan is starting to pay off in added sales, according to company reports, and the major problem right now is lack of dealer outlets which are necessary to boost sales in some key areas of the country. AM is presently aiming for 55 more dealers to fill out its U.S. sales coverage, and is ready to spend its own money to set them up. PS

Copyrighted material

"Look who's smiling now!"



Sometimes a man sets his ambitions high enough to make skeptics smile. But how often he gets the last laugh! "At the time I started studying with LaSalle, I was working as a factory clerk. Before completing the course I was transferred to cost accounting and my salary was increased by $1800. Now, having completed the course, I'm in charge of the department and headed for the five figure bracket. LaSalle's course helped me pull myself out of a boring and ill-paid job into a position of almost unlimited opportunity."

The words in quotes come directly from one of the pleased reports that are sent to us by LaSalle graduates. LaSalle files contain many letters from men and women who have increased their earnings with the help of LaSalle training. You, too, can prepare for the career opportunity of your choice through LaSalle home study —without interfering with your present work—and by devoting only a little of your spare time.

LaSalle has been a leader in home education for more than sixty years, enrolling over 2,000,000 ambitious men and women in its many courses. You study under the supervision of LaSalle's experienced faculty. Upon satisfactory completion of your study, you receive the LaSalle diploma—a recognized and respected credential.

Mailing the LaSalle coupon below may be the first step toward preparing yourself for a better job, higher pay, and the many good things that go with success. Simply check the program in which you are most interested, and we will send you a valuable free booklet describing the opportunities in that field. There is no obligation. LaSalle, 417 S. Dearborn Street, Chicago, Illinois 60605.

© 1972 LaSalle Extension University

LA SALLE EXTENSION UNIVERSITY

A Correspondence Institution • **417 S. Dearborn Street, Dept. 79-081, Chicago, Illinois 60605**

Please send me, without cost or obligation, FREE booklet and full information on the field I have checked below:

ACCOUNTING
- ☐ Complete Accounting
- ☐ Income Tax
- ☐ CPA Training
- ☐ Bookkeeping

BUSINESS MANAGEMENT
- ☐ Introduction to Business Management

DRAFTING
- ☐ Complete Drafting

REAL ESTATE
- ☐ Complete Real Estate
- ☐ Real Estate Brokerage
- ☐ Real Estate Management

DIESEL MECHANICS
- ☐ Basic Training

MUSIC INSTRUCTION
- ☐ Piano ☐ Guitar

LAW COURSES
- ☐ Bachelor of Laws Degree
- ☐ Business Law
- ☐ Insurance Law
- ☐ Claim Adjusting Law
- ☐ Law for Police Officers

No state accepts any law home study course, including LaSalle's, as sufficient education to qualify for admission to practice law.

TRAFFIC & TRANSPORTATION
- ☐ Complete Traffic Management

RESTAURANT MANAGEMENT
- ☐ Complete Executive Training

LANGUAGE INSTRUCTION
- ☐ French ☐ Spanish

COMPUTER PROGRAMMING
- ☐ Basic Training

INTERIOR DECORATING
- ☐ Complete Training

ART TRAINING
- ☐ Commercial Art
- ☐ Oil, Water Color Painting
- ☐ Complete Training

HIGH SCHOOL
- ☐ High School Diploma

HOTEL/MOTEL MANAGEMENT
- ☐ Hotel Executive Training
- ☐ Motel Management

STENOTYPE
- ☐ Machine Shorthand

CAREERS FOR WOMEN
- ☐ Accounting
- ☐ Bookkeeping
- ☐ Computer Programming
- ☐ Dental Office Assistant
- ☐ Interior Decorating
- ☐ Real Estate
- ☐ Secretarial
- ☐ Stenotype

Mr.
Mrs. . . . . Age . . . .
Miss *(Circle title and please print)*

Address . . . . . Apt. No. . . . .

City & State . . . . . Zip . . . . . .

53D

Copyrighted material

Recreation Roundup

. . . on the go with PS

By HERBERT SHULDINER

New flotation kit turns your RV into a houseboat

You can convert your travel trailer, camper, or tent trailer into a houseboat by anchoring it on the MagicIsle—a catamaran-like craft with two fiberglass hulls. Its deck is 26 feet long and 12 feet wide, and you can mount one or two outboard motors for power. It will take on a load of up to 4,500 pounds. Draft unloaded is seven inches; under full load, about 10 inches. The canopied forward deck is 12 feet square. The MagicIsle is made by Arcmarine Corp., 2370 N. Flower St., Santa Ana, Calif. 92706. All aboard, campers!

High-flying bicycles

The jet age is catching up with booming bicycling. United Air Lines has a new bike box for flying your bike along on trips safely, easily—and cheaply. The box will hold a touring or racing bike. Pedals and handlebars are encased in Styrofoam or are removed to fit into the box. The boxes will be provided to bike owners, but standard excess-baggage charges apply. The minimum charge is $4; maximum, $8 ($6 for a trip from New York to California). You pick up your box at the airport ticket counter.

Now how about the rental car companies offering optional bike racks for the pedal-pusher set?

Do-it-yourself-outdoorsman

If your trailer has a side access door to a compartment that's as deep as the trailer is wide, you know that a lot of space is inaccessible. Here's a simple solution: Make a pull-out tray of plywood or hardboard, framed with one-by-ones or one-by-twos. Make it almost as wide as the door and nearly as long as the trailer is wide. Install nylon drawer rollers just behind the door and on the bottom of the tray's far end. Remaining space will still take fishing rods.

Things to write for

AC has a new catalog for sport vehicle owners that gives revised data on RV and marine (and lawn mower) spark plugs. It's free from AC Spark Plug Div., Public Relations Dept., 1300 N. Dort Hway, Flint, Mich. 48556.

If fishing is your thing, write the Newton Line Co., Homer, N.Y. 13077, for their folder, "Line Tips for Fishermen." It contains 27 good tips from leading outdoor writers.

"Your Land, Your Jeep and You" is a well-written pamphlet on the intelligent use of off-road vehicles. Jeep distributes it with every vehicle sold, but you can get a copy from American Motors Corp., Dept. JB, Detroit 48232.

Sportsman's calendar

On July 10-14, the National Campers and Hikers Assn. holds its 13th convention at Camp Atterbury, near Columbus, Ind. Nearly 9,000 families are expected.

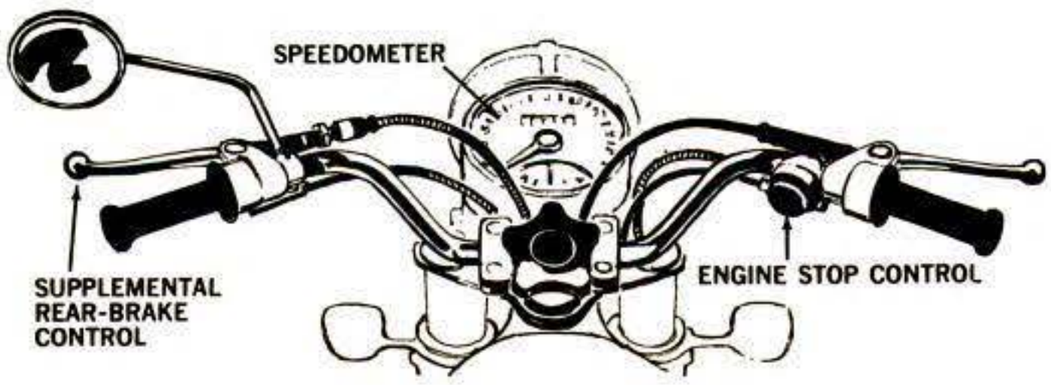
On July 28-30, the Seventh International BB Gun Championship Matches will be held on the campus of the University of Tulsa (Okla.).

Tow bar lets your bug hitch a ride

This new heavy-duty rig makes towing VW Bugs or dune buggies behind big RVs simpler because it provides for quick attachment to any standard two-inch ball. Two safety chains are included. It's made by Valley Tow-Rite, 27 E. Vine St., Lodi, Calif. 95240.

Now they're standardizing handlebar controls for motorcycles

Heard about DoT's new standards for motorcycle controls? They must be operable without your hand leaving the grip, with the engine-stop control on the right handlebar. If there's an automatic clutch with a supplemental rear-brake control, it must be at the left. On a bike with self-proportioning or antilock braking, with a single control for front and rear brakes, the control must be located like a rear-brake control. An illuminated speedometer and neutral transmission position are required. Cycle stands that make ground contact when moving forward must fold rearward and upward.



Wanted: more marinas for boatmen

Boat ownership has jumped about 25 percent during the last decade, but the number of new slips has increased only enough to accommodate one-eighth of the new boats. George Rounds, assistant secretary of the National Assn. of Engine and Boat Manufacturers, says this indicates how our demand for recreational facilities is "far outpacing provisions." Rounds urges that additional shore service areas be provided by redevelopment rather than by building in virgin wetlands—"the destruction of which would be a loss to boatmen more than any other group." He cites two examples of the right way to do this: Chicago's Marina City and the South Street seaport in New York City. Most important is that it's in such areas that we need the facilities most. But the redevelopment idea works anywhere. PS

Copyrighted material

Chevrolet. Building a better way to see the U.S.A.

Chevelle Malibu Sport Coupe at Six Flags Over Georgia Amusement Park in Atlanta.

Highway safety begins at home. Buckle up before you leave.

Have you noticed how many young families get carried away with Chevelle?

They get carried away to places like the Six Flags amusement park in Atlanta, Georgia, with over 250 acres of history and fantasy and fun.

"To get carried away with" implies an emotional reaction. With Chevelle, that's only partly true.

Fits more families.

The reasons more young families get carried away with Chevelle, the reasons it's become America's most popular mid-size car are solid, quite solid indeed.

The Chevelle interior is spacious for a mid-size car (or any size car, for that matter).

It fits a family of six nicely.

Fits more vacations.

And the Chevelle body provides your family with protection wherever you travel. It's an all-welded superstructure, incorporating solid steel side guard beams in each door and a steel cargo guard that walls off the passenger compartment from the luggage in the trunk.

That trunk, incidentally, holds 12 cubic feet of overnight bags, two-suiters, golf clubs, balloons or whatever.

And even if you run into some bad roads or have to take a detour, you'll travel smoothly and comfortably on Chevelle's Full Coil suspension.

Fits more budgets.

Price, of course, is terribly important when you're planning on both a new car and a vacation.

Don't worry. Chevelle's price is also mid-size. And its resale value is full-size—traditionally higher than other cars in its field.

One more thing. The readers of *Car and Driver* magazine recently picked Chevelle as the year's "Best Intermediate Sedan."

So please give our best to your family. And have a nice trip.

Chevrolet

Copyrighted material

PERSONAL-USE REPORT

Lazy Man's Light Switch

Light and TV control from bedside is easy with surface switches.

If you're an armchair electrician, adding a light switch to your home is easy: Just break the hot line from any light and "out it goes." But to the man who actually does the work, it means snaking wire in and out of impossible places, cutting holes in a perfectly good wall, nailing up switch boxes, and—if he's misjudged—patching, repairing, and repainting oversize holes.

Finally someone has made things easy. Switchpack is a low-voltage pushbutton system that mounts *on* the wall, not *in* it. Extremely thin (.005-inch) two-conductor wire with an adhesive backing runs along the wall surface and is easily covered with two coats of paint or wallpaper. Two screws hold the pushbutton in place.

Heart of the Switchpack system is the power unit, which fits inside a standard outlet box. The unit contains a small transistorized circuit that controls a solenoid-activated ratchet switch. Each time you press a wall button, the two-volt circuit pulls in the solenoid, alternately turning the light circuit on and off.

Because the system works with only momentary contact switches, a normally complex wiring job becomes extremely simple. If you want to control one light with any of four wall switches, for example, all you need do is parallel all the wires from each switch. Any switch will then close the circuit controlling the light.

Switchpack is under $12 from Switchpack Systems, Inc., 199 Alewife Brook Parkway, Cambridge, Mass. 02138.
—*W. J. Hawkins*

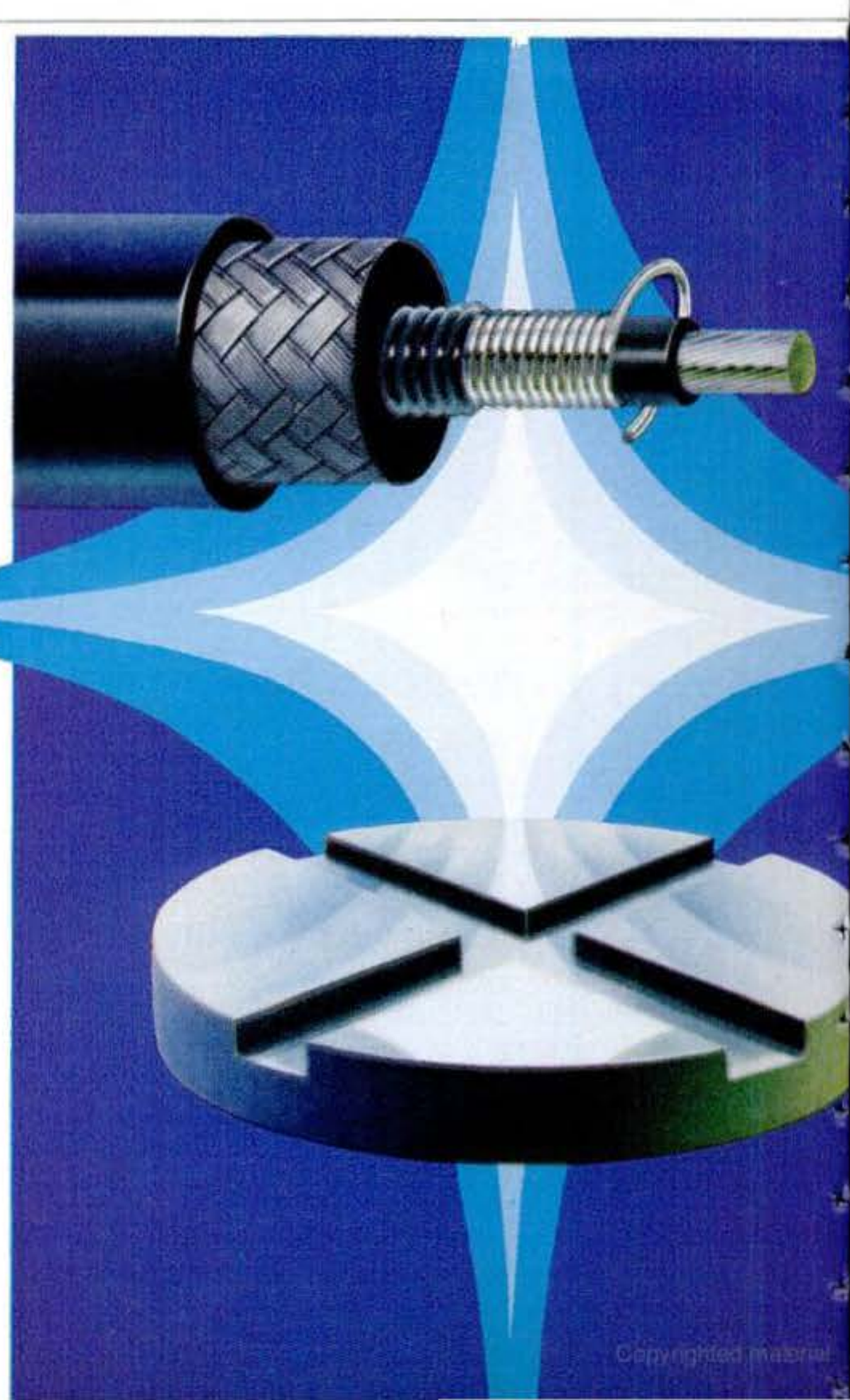
Flat two-conductor wire, adhesive-backed, connects power pack to all switches.

Here's an engineered ignition system with the kind of extra power that takes you miles beyond tune-up time. At top performance all the way. *Magnition*™ is Sorensen's *Mono-Mag*™ spark plug cable, the *real wire* wire that delivers maximum usable voltage to the plugs through Monel wire that's coiled around iron-impregnated neoprene to eliminate annoying radio static interference. *Mono-Mag's* real wire conductor helps insure full combustion for better mileage and top performance. Keeps exhaust emissions down, too. *Magnition* is Cross Cut points, the only point set you can buy with unique, patented four-way ventilation that keeps contacts cooler than conventional ventilated points. Because they run cooler, they run longer without pitting or burning. They're specially engineered with coordinated spring tension and special rubbing block material to assure constant dwell settings and no "point bounce" at high RPM. Best for any stock distributor.

Magnition is more: alkyd-cased epoxy coils for higher available voltage at operating temperatures; non-arcing, precision molded distributor caps and rotors designed to maintain ignition system balance for all those extra miles.

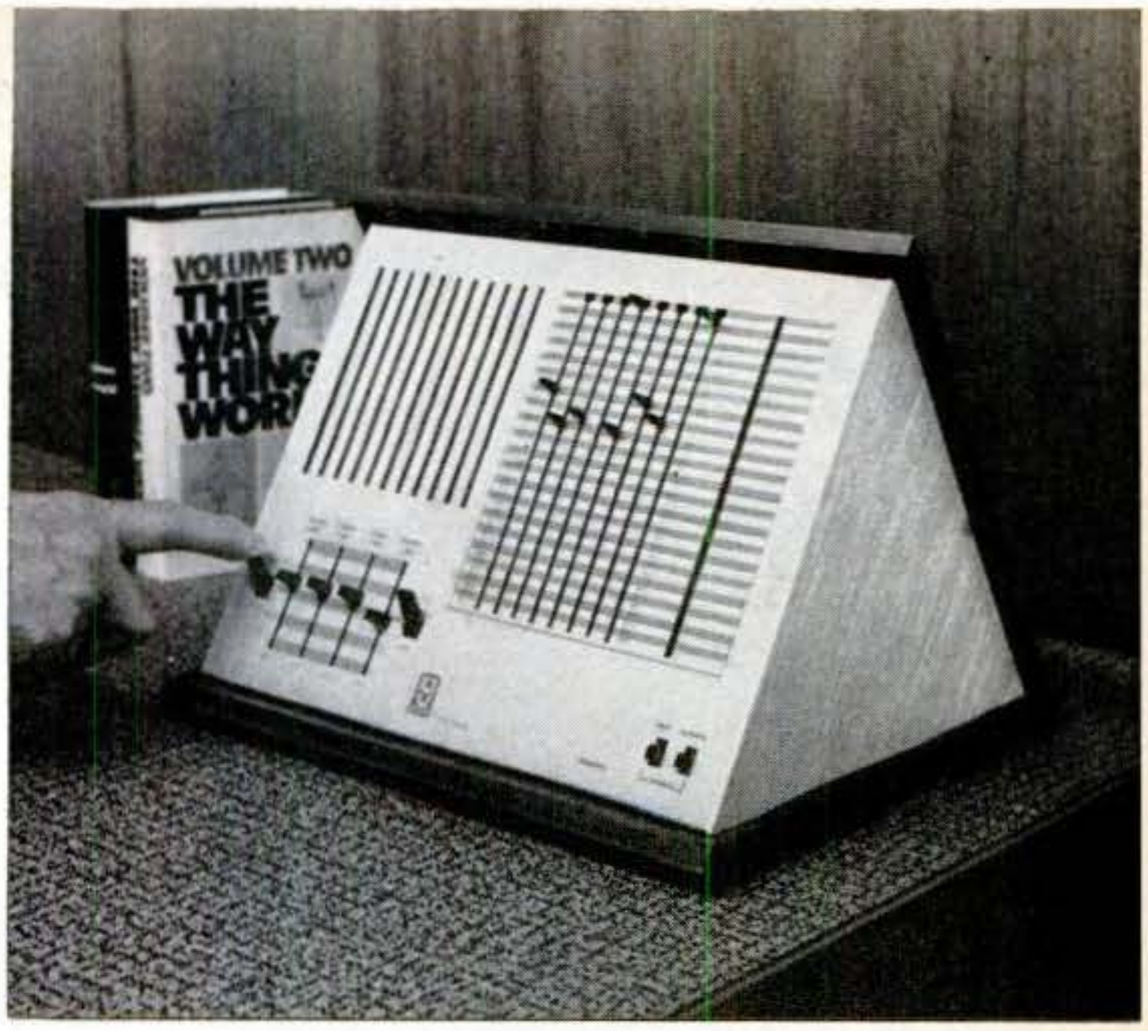
It all means sure power for full combustion that boosts mileage, keeps exhaust emissions down. Next time you get a tune-up, make sure it's *Magnition*. Part of the full line of quality replacement parts for your car made by Sorensen Manufacturing Company, Inc., Glasgow, Kentucky 42141

Send Today for Ignition Facts brochure and get all the details on *Magnition*, the extra power ignition system.



MUSE—
Space-Age Music Box

Electronic composition is a cinch with this desk-top musical computer



"It plays Martian music," quipped a friend of mine on first hearing the Muse. The melody—based on my phone number—really *was* out of this world: electronic music with a strange-but-pleasant, reedy sound.

The Muse is actually a small digital computer designed for music-making. There are more than 14 trillion potential note combinations inside this unique instrument and, according to the designers, it can play for as long as 30 years without repeating itself. It contains a vast system of binary devices—thousands of tiny transistors turning on and off to generate programed notes. A row of blue and green lights signals the on-ness or off-ness of these transistors.

On the right side of the Muse's front panel is its Composer Section: four "Interval" switches and four "Theme" switches, each sliding through a range of 40 numbered settings. The former control the notes to be used in a particular composition, while the latter create variations on the basic melody. To the left, the Conductor Section provides controls for volume, tempo, and pitch.

By connecting two or more Muses, you can create complex effects in harmony or counterpoint. Hearing a "choir" of Muses is a remarkable aural experience.

MIT Professors Edward Fredkin and Marvin L. Minsky, co-inventors of the Muse, put together a breadboard version in Minsky's kitchen a few years ago. Now the production model, handsomely housed in a walnut and brushed-aluminum cabinet, has reached the market. It sells for $249—a bargain when you consider that only a million-dollar digital computer can duplicate its performance.

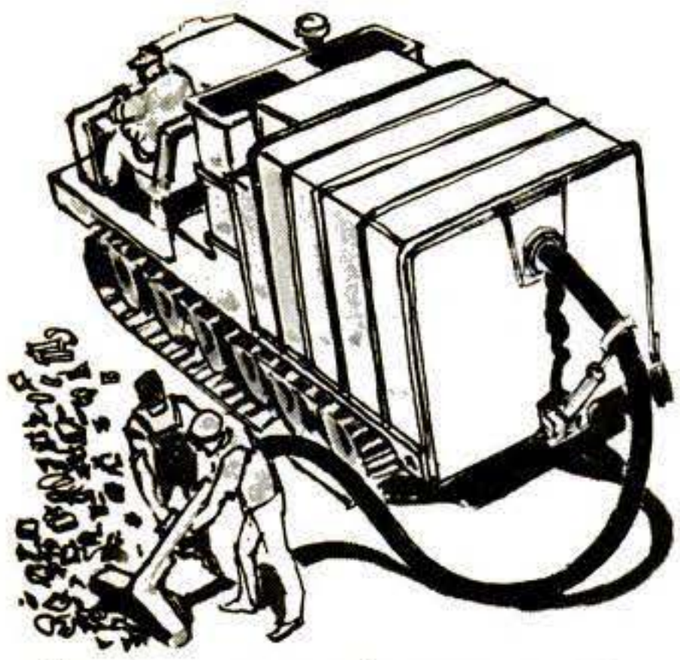
Although a musician or computer expert might get more out of Muse ownership than will someone who is neither, it is a musical instrument that anyone can play. I'm in the "neither" group and have had many hours of fun from this electronic music maker.—*Paul Wahl*

magnition
the extra power ignition system
Sorensen

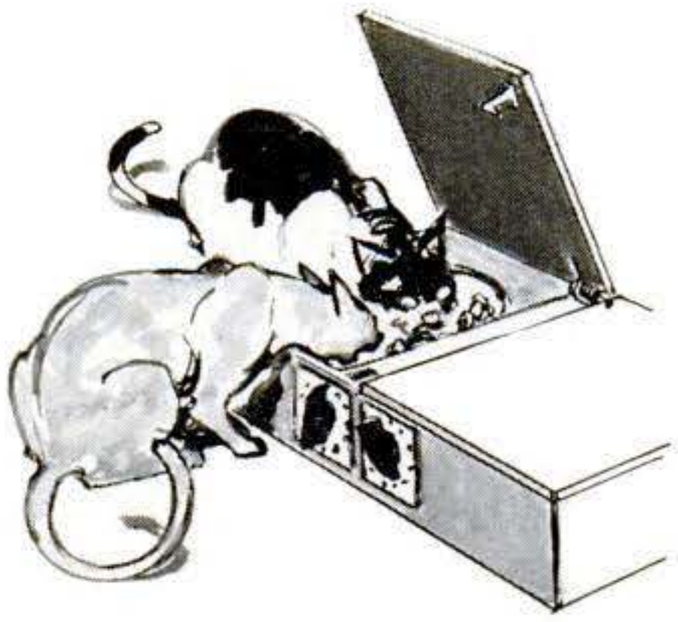
New Ideas from the Inventors

ILLUSTRATIONS BY DANA RASMUSSEN

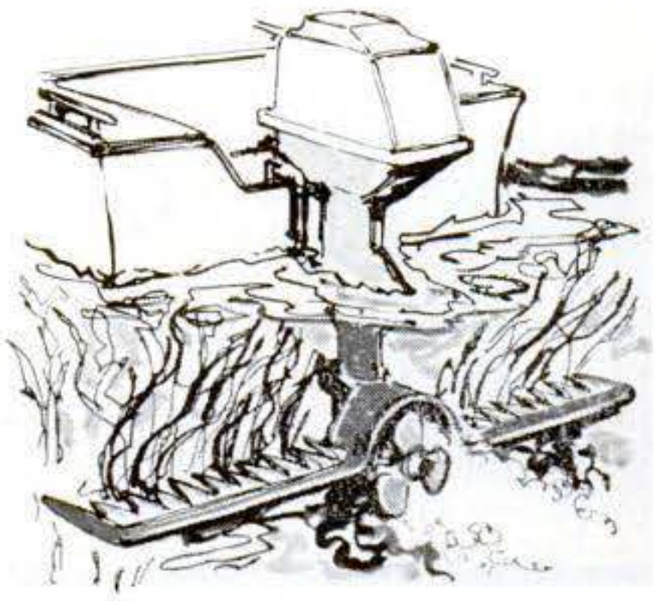
Fold-out room extends camper. Supported at its outer end by pivoted, adjustable jacks, this recently patented panel would form the floor of an extra room on a parked camper. An awning support for a windowed fabric or plastic cover would unfold with the floorboard. While the camper was in transit, the framed panel and enclosed supports would lock flat against the back wall.



Tractor vacuums plant waste. Maneuvering in limited space on smooth or rough surfaces, this tractor-carried loader would vacuum refuse from streets or industrial sites and carry it to a disposal or recovery area. Air from the high-powered blower would be filtered before it was discharged.



Pet feeder times weekend meals. You wouldn't have to cut short your away-from-home weekends because of an untended pet if you left its food in a timed dispenser like this. You'd put a day's food in each compartment and set the timer to open the spring-lifted lids at 24-hour intervals.



Outboard fitting clips weeds. Coupled to the drive shaft of an outboard engine, this underwater weed cutter would propel itself—and the boat—as it snipped away channel-fouling marine growth. Boat and cutter could be steered in the usual way; different próps could be used to adjust speed.

Holder starts screws. A screw wouldn't tilt or sideslip under starting pressure if it was held in this positioning guide. You'd press the screw into a slotted rubber collar and insert both into a transparent sleeve slipped over the driver shank. The rubber cylinder would steady and guide the screw without blocking its advance

Bucket loads roller. You could roll on more paint in less time with a bucket like this. It would hold more paint than a conventional tray and would be easier to carry and more slosh-resistant. Stable and square-framed, it would stand upright on any flat surface. Curved bottom would let roller pick up virtually all paint.

The following patents have been issued on these inventions: **Fold-out camper room**—*No. 3,511,529 to George F. Cutsinger, Detroit;* **Tractor-loaded vacuum**—*No. 3,541,631 to Burnett M. Kluge, Brookfield, and Howard E. Paulson, Waukesha, Wis.;* **Pet feeder**—*No. 3,532,075 to Norman Cooper, W. Haverstraw, N.Y.;* **Marine weed cutter**—*No. 3,499,271 to Leonard E. and Thomas E. Drigert, Racine, Wis.;* **Screw starter**—*No. 3,532,142 to Harold B. Ziegler, El Paso, Tex.;* **Roller bucket**—*No. 3,493,988 to James O. Tidwell, Mountain View, Calif.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D.C. 20231, at 50 cents each. To write to an inventor, if the address given here is insufficient, address him (by name and patent number) in care of the Commissioner.

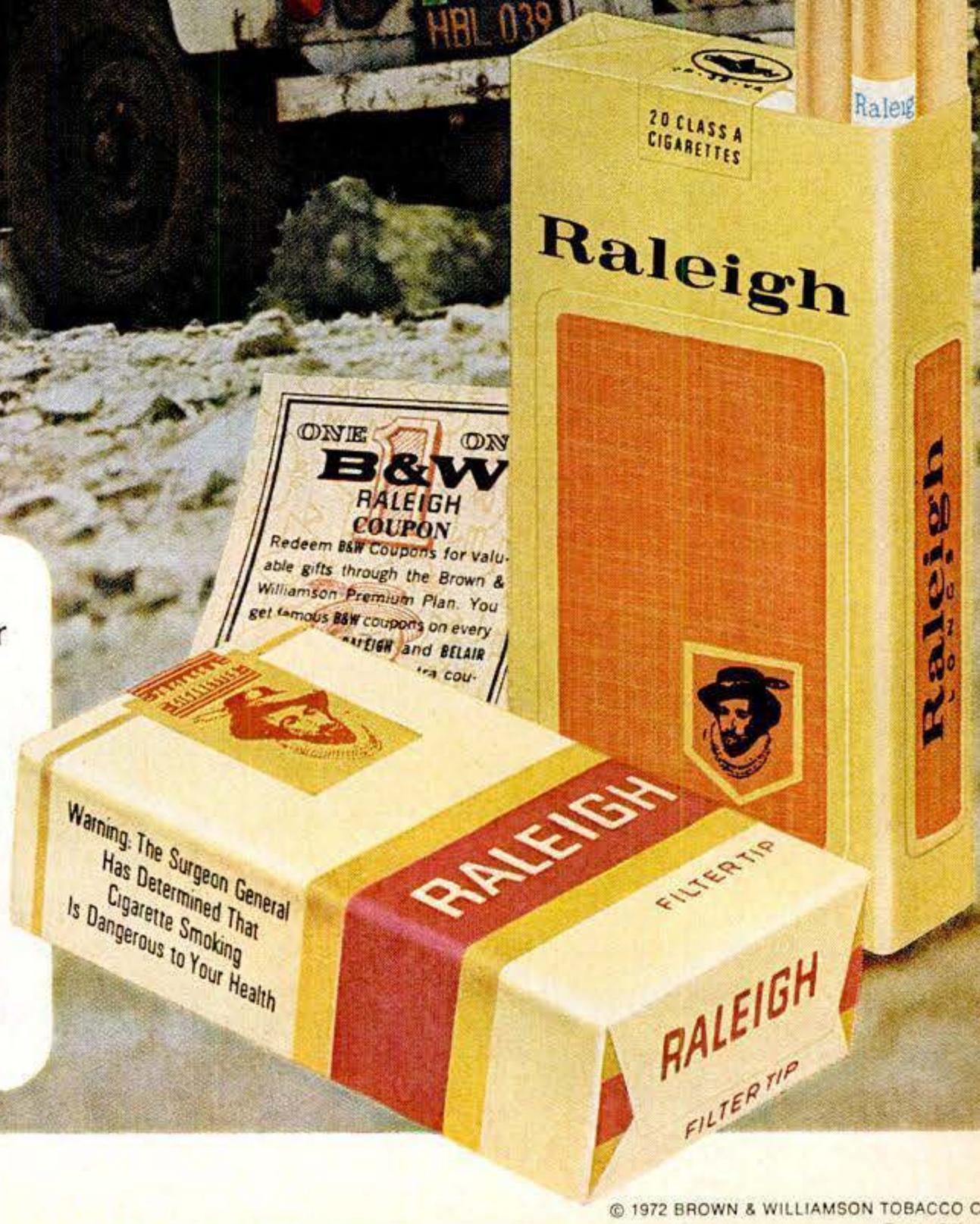
Copyrighted material

Spend a milder moment with Raleigh.

Highest quality tobaccos–specially softened for milder taste.

You'll enjoy a day in the backwoods more if you take along an Igloo Cooler Chest like his. You can get one for free Raleigh Coupons, the valuable extra on every pack of Raleigh.

To see over 1000 other practical and valuable gifts, write for your free Gift Catalog: Box 12, Louisville, Ky. 40201.



Filter Kings, 17 mg. "tar," 1.2 mg. nicotine; Longs, 18 mg. "tar," 1.3 mg. nicotine, av. per cigarette, FTC Report Aug. '71

© 1972 BROWN & WILLIAMSON TOBACCO CORP.
Copyrighted material

"Say, Smokey—"

A clinic on cars by America's most famous mechanic

Each month in POPULAR SCIENCE Smokey Yunick answers questions on cars—family cars, high-performance jobs, hot rods, and racing cars—selected from those sent in by readers. Got a problem? Send it to: "Say, Smokey—" Popular Science, 355 Lexington Ave., New York, N.Y. 10017. Questions cannot be answered by mail.

I own a 1966 Corvair Monza. The 140-hp engine has four carburetors. Is it possible to install a turbocharger on this engine? If so, what changes would have to be made and what would the effects be? Would there be any problems such as tuning or lowered gas mileage?

DAVID SMITH, Sioux City, Iowa

It is possible, and with the job done right that car would be pure hell on wheels. Tuning would be no problem and mileage should be very good. But don't try to install the unit yourself! Only an above-average automobile engineer, very much carb-oriented, could handle this. Turbochargers are really not an add-on—they must be bred into the engine.

My problem is tires on a '68 Fury with A/C. The right front tire of the last three sets of G70 Douglas Polyester Fiberglas has shown excessive wear on the inner two beads—despite three alignments, wheel balancing and new shocks. No one else has an answer, but I hope you do.

FLOYD POLAN, Stamford, Conn.

Well, your right front tire is still out of alignment and those two beads wear out first because that area of the tire is doing too much work in reference to the rest of the tire. Have the alignment checked with your normal load in the car. I suspect that when you climb in the car the attitude of the suspension changes from what it is when the car is empty and on the rack. Also have the rear axle alignment checked for track and wheelbase. The rear end running out of line will push the front end into abnormal tire-wear patterns.

I've been considering buying a new car, but don't know whether to get one with disk brakes or shoe brakes. I've asked several different people and received a different answer from each one. What's your opinion on which is best?

BRIAN KANEEN, Pasadena, Calif.

The safest and best are disk brakes. They're not necessarily the cheapest, but when you consider the value of your own hide, disks are by far the best buy.

Ever since I purchased a new 1971 Plymouth Cricket I've been plagued by a problem my dealer's mechanic is unable to figure out. At 30 mph there is a vibration that can be felt throughout the car. At speeds above 55 the vibration intensifies and the steering wheel vibrates greatly. The front end has been checked and the tires balanced, with no success. The dealer checked with the factory representative, who was also at a loss to explain what was wrong. The tires don't show excessive wear at 7,500 miles. Help!

D. E. WYBLE, Lebanon, Pa.

I'd start with four straight wheels and four round tires, balanced. Then, if the vibration still exists, take the car out of gear at 30 and then 50 mph, and shut the engine off at those speeds. I think the problem's caused by an unbalanced engine, the drive line out of balance, a crooked wheel-tire combination, or possibly a sympathetic resonance built in accidentally.

At 66,000 miles my '66 Corvette has developed a ping which I can't get rid of. I've changed plugs and points. The timing and dwell are set to factory specs. The idle mixture has been set, and the heat riser valve and thermostat are working. The ping occurs on the highway when accelerating from 55 mph and up. There is no accompanying loss of power. The temperature gauge indicates the engine isn't overheating. I tried retarding the timing a little, but it didn't help.

TODD NICHOLSON, Marion, Ind.

Pull the heads and clean the carbon, and the ping will disappear. But before you pull the heads check for piston-ring condition by the blow-down method. When the heads are off, check the valve guides and replace the valve-stem seals.

Ever since my 1969 Olds Wagon was new, the battery runs dry about every 30 days. The mechanics have checked the charging rate and found it okay. It is a heavy-duty battery and I have many power accessories. Any suggestions?

MARTIN J. ROSTEN, M.D.
El Cajon, Calif.

Your battery is getting too hot, either from being too small for the demand on it, or because it's in a poor ventilation area—or possibly from both conditions. Also, it could be running in a low-charging condition because not enough long runs and lots of heavy draw are keeping the charging system at maximum draw all the time.

I have a 1970 Catalina with 400-c.i.d. engine, A/C, and power. The dealer replaced the seal on the main rear bearing at about 13,000 miles because it was leaking. I now have about 21,000 miles on the car and the seal has to be replaced again, and so does the timing seal. Both are leaking oil. I assume that the engine with emission controls has too much internal pressure, which is causing leaks at both ends. What can be done to prevent this condition again after the dealer replaces both seals? Is this common on recent cars with sealed engines and emission controls?

JOSHUA REZNICK, Philadelphia, Pa.

Assuming that the seals have been installed properly and you have more than normal crankcase or internal pressure, there is nothing that will stop the leakage short of reducing pressure or using seals that can control both oil and pressure. The seals that are used in your engine can't withstand much pressure. I suggest you have your dealer check the crankcase pressure and see if it is normal. You may have a piston-ring problem, which will show up in a pressure check.

In my 302 V8 1962 Mercury Montego, the number-two spark plug in the left bank misfires after three or four months' use—because melted steel has closed the electrode. All plugs are gapped at .035 and the electrodes, except for number two, appear normal. The radiator won't stay full and is always ½ gallon low on water. Is this hot cylinder due to faulty circulation, or valve trouble? The other plugs give good service for 8,000 miles. Most of my driving is on the highway, during weekends. The other five days the car is garaged.

C. C. MORRIS, San Francisco, Calif.

Have the engine compression checked by the single-cylinder blow-down method, with the engine full of water and the radiator hose off from the water return to radiator. If bubbles are observed, then one or more cylinders is leaking compression into the water system. Nine times out of ten that means head-gasket trouble. The cylinder that burns up one plug is burning extra hot for one of three reasons: water, fuel mixture too lean, or pre-ignition. Pre-ignition could be from a hot spot in the combustion chamber caused by carbon, a piece of gasket hanging over, or a sharp edge in the combustion chamber. If one hole is lean, it could be from a leaking or bad intake runner in the manifold casting.

A year ago last November I purchased a 1971 Ford LTD equipped with power steering. When I turn the steering wheel to park, or to back out of a parking place —or even when I just make a half-turn to come into my driveway—the wheel catches. It will not go any farther and I have to make a big sweep. This doesn't happen all the time. Sometimes it goes

Continued

Dodge. The only all-new pickup for 1972...with no cover charge.

Buy this specially equipped '72 Dodge Sweptline, and the Dodge Boys can offer you a Winnebago® Kap® Cover at no extra cost.

FOR '72, ONLY DODGE GIVES YOU ALL THIS:

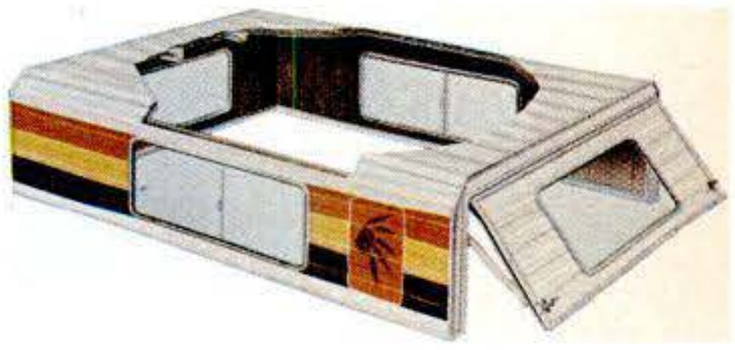
- All-new styling, inside and out
- New, improved independent front suspension
- More cab room
- Bigger payload capacities in most models
- New car-style cab comfort
- Easy-off tailgate.

PLUS A $300 VALUE AT NO EXTRA COST.

The Winnebago Kap Cover is constructed of aluminum with insulated walls and plywood paneling inside. Participating Dealers can offer you this great value FREE because Dodge gives it to them free. See the specially equipped Dodge D100 V8 131-inch wheelbase Sweptline Topper today.

SPECIAL EQUIPMENT INCLUDES:

- Automatic transmission
- Adventurer Package
- Power steering
- Tinted windshield
- Electronic Ignition System
- Bright rear bumper
- 15-inch wheel covers
- Mirrors, bright, dual, 5" x 7"
- Heavy-duty rear springs
- Front bumper guards.



®Winnebago and Kap are registered trademarks of Winnebago Industries, Inc.

Dodge brings you the best in baseball Saturdays on NBC. See your local TV listing.

DODGE SWEPTLINE TOPPER

...IT'S A GREAT DEAL BECAUSE DODGE STARTED WITH A GREAT PICKUP.

Copyrighted material

We'll make you expert at whatever turns you on.

Today's Army can make you an expert at whatever you like best. And do best.

We can teach you all there is to know about tearing down an engine, fixing a television set, forecasting the weather.

We have more horsepower than the Motor City. Cameras that can take a portrait of a bird a half-mile away. Electronic equipment so new it hasn't even been named yet.

With more than 300 job-training courses to choose from, today's Army can take that favorite talent of yours and turn it into a rewarding lifetime career. And if you qualify, we'll guarantee your choice of training in writing. Before you enlist.

If you'd like to learn more about the opportunities to learn a skill in today's Army, see your nearest Army representative. Or just send the coupon.

Today's Army wants to join you.

Army Opportunities
Dept. 200, Hampton, Va. 23369

Date _____

2PS 7-72

I'd like to know more about the job training courses in today's Army.
Send me your free book.

Name _____ Date of Birth _____

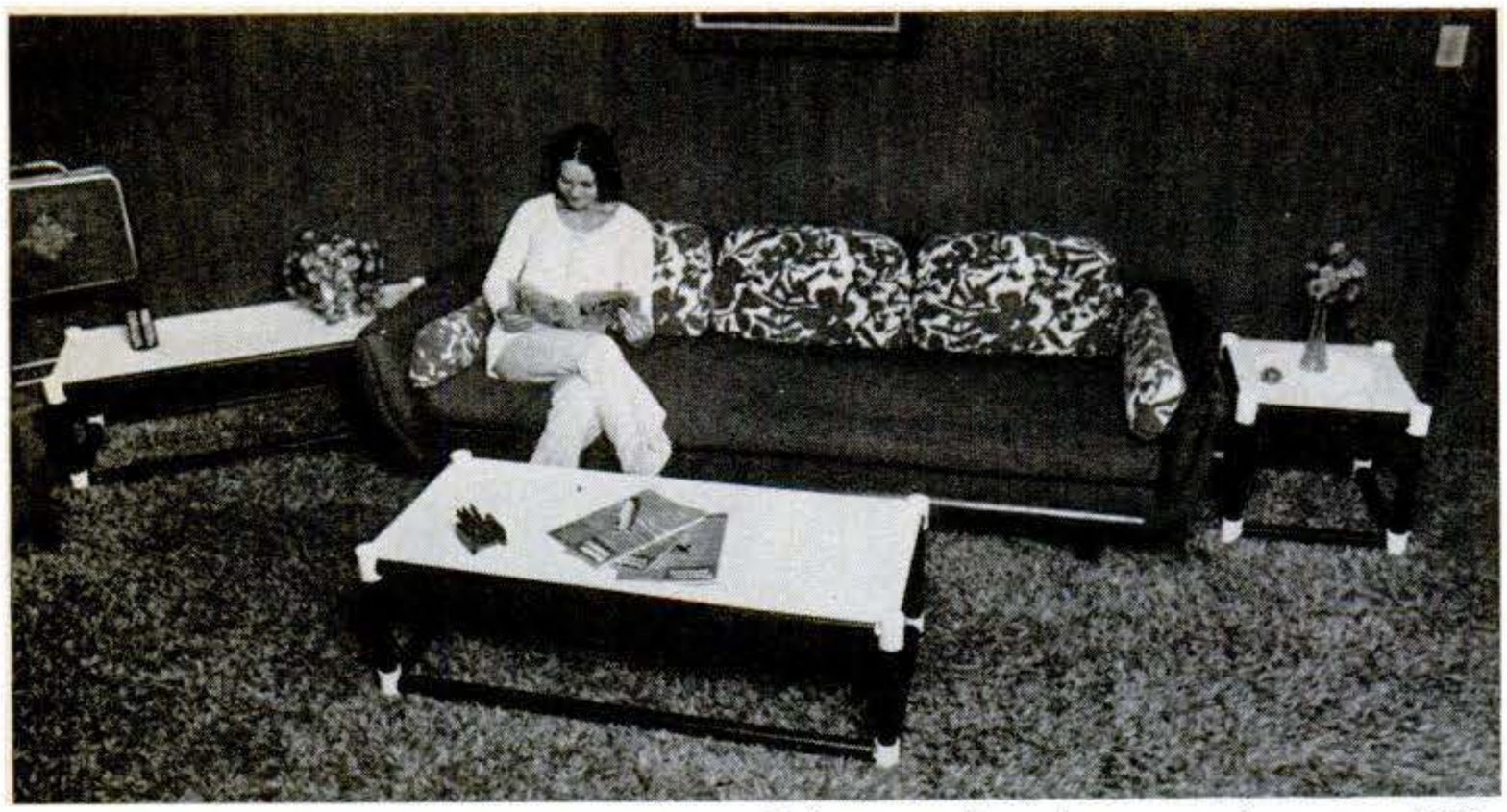
Address _____

City _____ County _____

State _____ Zip _____ Phone _____

Education _____

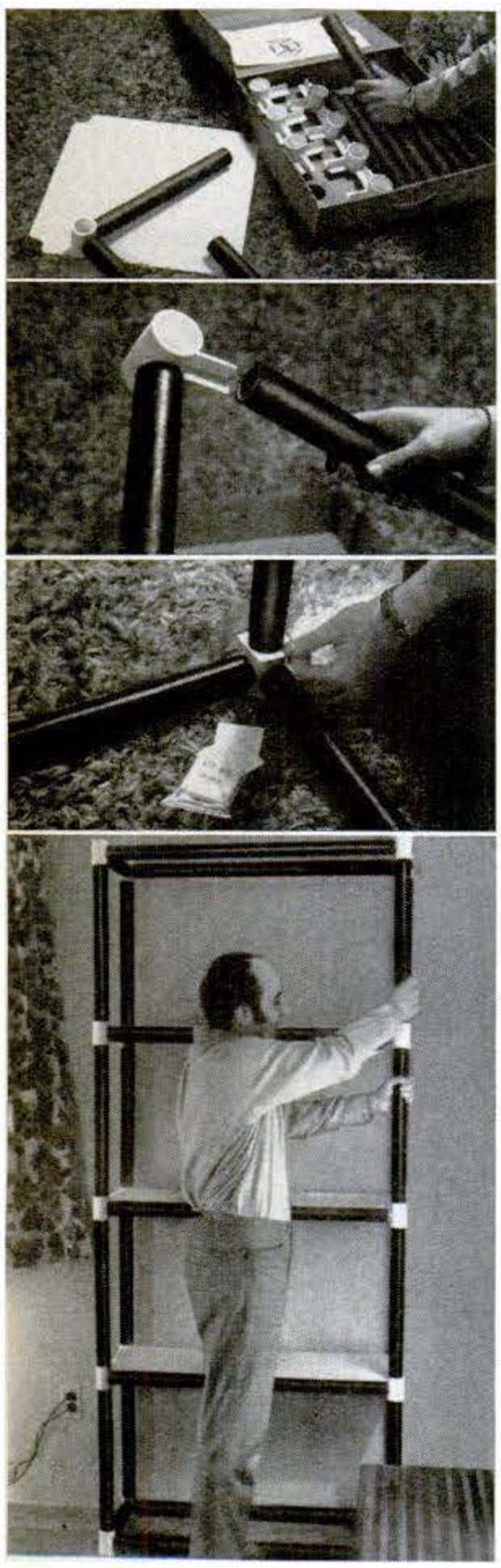
Copyrighted material



These tables were built in just minutes and they can be taken apart just as quickly.

PERSONAL-USE REPORT

SET-UPS...knockdown, use-again cardboard furniture



No tools needed—each piece slides tightly into place. Sheets of paper inserted in each joint make even this high shelving stand rigidly.

The next time you throw away the cardboard backing on your new shirt or toss out the container your orange juice came in, do it with enthusiasm. You may have just helped build your new coffee table for the living room.

Sound crazy? Not to Environmental Concepts, who have been building a whole line of furniture out of just that—recycled cardboard.

Aptly named Set-Ups, this furniture comes broken down for hand carrying and sets up in minutes as—depending on the kit you order—a desk, chair, coffee table, bookrack, or whatever, without tools.

Cardboard tubes, laminated for extra strength, slide tightly over the fingers of each plastic joint to form the horizontal supporting bars. Vertical supports rest inside the cupped top of the joint. Small sheets of paper (supplied with each kit) may be added if necessary between the cardboard and plastic to make a snug fit. Once the supports are in place, a ¼-inch precut plastic sheet rests on top. Set-Ups are remarkably strong for their lightweight construction, and under normal loads will easily replace their wooden counterparts.

I found it necessary to use the paper sheets in every joint, especially on the larger pieces. On the shelving, the sheets made the difference between a wobbly structure and one that was as rigid as any stacked wooden unit. Bear in mind, however, that it *is* cardboard and your hi-fi components, for example, will have to seek another home. But medium-sized books, lamps, vases, and the like (things usually found on shelving) will find Set-Ups unyielding.

Looking for an inexpensive way to fill a spare room or summer house? I'd recommend Set-Ups as the perfect answer. You have a choice of colors, and prices run from $7 to $30. They're from Environmental Concepts Products, 9100 Wilshire Blvd., Beverly Hills, Calif.—*W. J. Hawkins.*

"Say, Smokey—"

[*Continued*]

for two days without trouble. For the past nine months the dealer has had the car in his garage three times. First time a new pump, next time they said it leaked, and the third time a whole new kit. The problem's still there. Could something be wrong with the front wheels? The problem occurs only when I turn—either left or right.

G. E. McMahill, Rock Island, Ill.

I just hope I don't meet you on the road if it's still doing that! You could have many things wrong, but to start with, get someone to unhook the drag link and run the steering from lock to lock and see if it's smooth and free. If not, the trouble is in the steering-gear bearings, or worm-and-pinion teeth or bearings. It could be in the power-steer control valve, but I doubt that. Then there's an outside chance there might be some interference in the linkage. Have that checked also. Now, all my story is based on your statement that it will not go any farther, and is locked. But if you meant to say that it gets very hard to turn, then it could be a lack of hydraulic power—and a whole new ball game.

I left the dome light on for 26 hours in my 1971 Ford LTD. When I discovered the boo-boo everything in the car was dead. After using jumpers and starting the engine I ran it for 30 minutes, and the battery was okay. The next morning there was even enough juice to start the engine, and run the lights, radio, and heater. Is it possible for that one small light to completely kill the battery? Also could it be okay again after running the engine only 30 minutes?

Ernest H. Chadwell, Hamilton, Ohio

Yep—it's possible and you just proved it. The 12-volt batteries we use today in cars have a lot of wallop in reference to starting, etc. But they have a low capacity in time-power capability compared to the old six-volt systems. They go down quickly, but they return just as quickly.

I own a 1968 Cadillac with a 365 engine and A/C. During stop-and-go city traffic the car only gets between six and seven mpg, but in straight highway driving it delivers 15 to 18 mpg. I know that city driving uses up a lot more gas, but is there anything I can do to improve the mileage in stop-and-go driving?

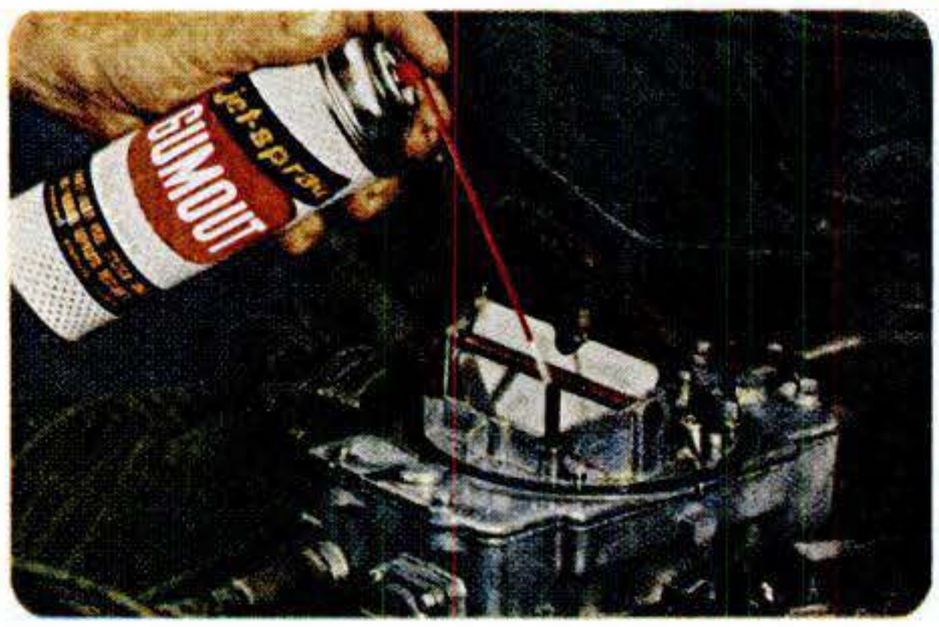
Peter D'Amico, Brooklyn, N.Y.

When a car that big and heavy gets the kind of mileage you're getting on the highway, there is very little you can do to the engine to improve it. Any major improvement in city mileage will have to come from a change in driving habits. Accelerate slower and smoother, get off the throttle when you see you will have to stop, so you use less throttle and less brake. In other words, anticipate traffic and try not to overrun and brake. Drive like you've got an egg between your foot and the accelerator pedal, and you'll be surprised to see how your city mileage improves. PS

Copyrighted material

The clean team

Take a typically dirty carburetor (like yours maybe) clean it...and get easier starting, smoother idling, no stalling, faster take-offs and better mileage.



1 **Clean it outside in seconds with Jet-Spray Gumout.** Takes less than a minute to get **this!** Throat, choke valve, linkage, throttle plate—all clean like new. Grime and gum that can foul up the carburetor's job are gone. Completely.

2 Now pour a pint of Gumout in your gas tank. **It does the same great job inside your carburetor as you drive.** Cleans out all the jets and passages, removes the gum and varnish.

GUMOUT Division
PENNSYLVANIA REFINING COMPANY, Cleveland, Ohio 44104

Copyrighted material

POPULAR SCIENCE • CAR TEST • NORBYE/DUNNE REPORT

Those Mini-Pickups:

Zippy, Smart, and Easy on Gas

You get half-ton payload capacity in economy-car size. Is it the answer for you?

By JAN P. NORBYE
PS Automotive Editor
and JIM DUNNE
PS Detroit Editor
PHOTOS BY ORLANDO GUERRA

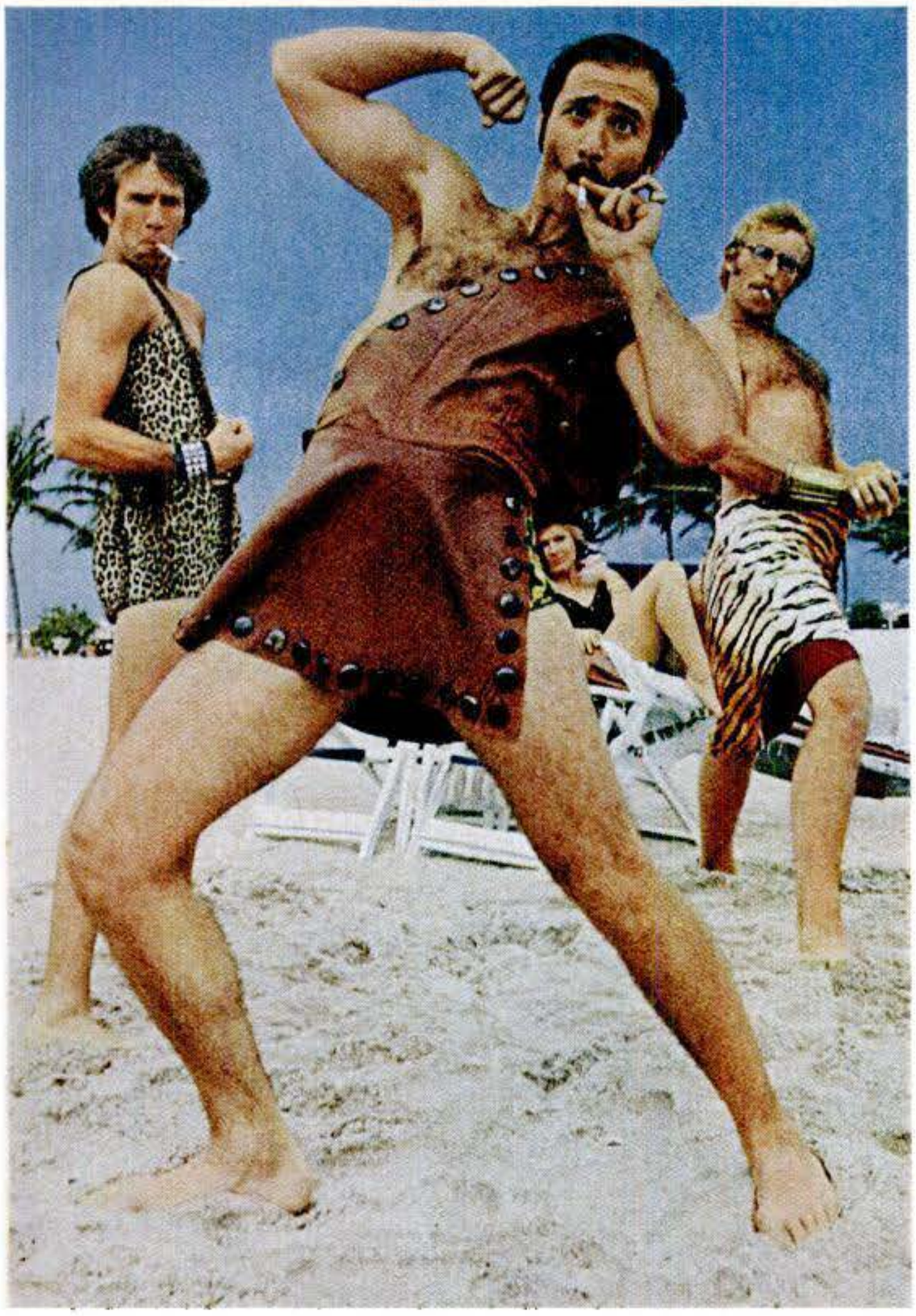
If you can't find exactly what you want in any station wagon, and you don't want a big truck, perhaps one of these mini-pickups is for you. About 200,000 of them are expected to be sold in the U.S. this year. Last year it was "only" 91,000, but the arrival of new trucks with Ford and Chevrolet labels is causing an explosion in the market.

Continued

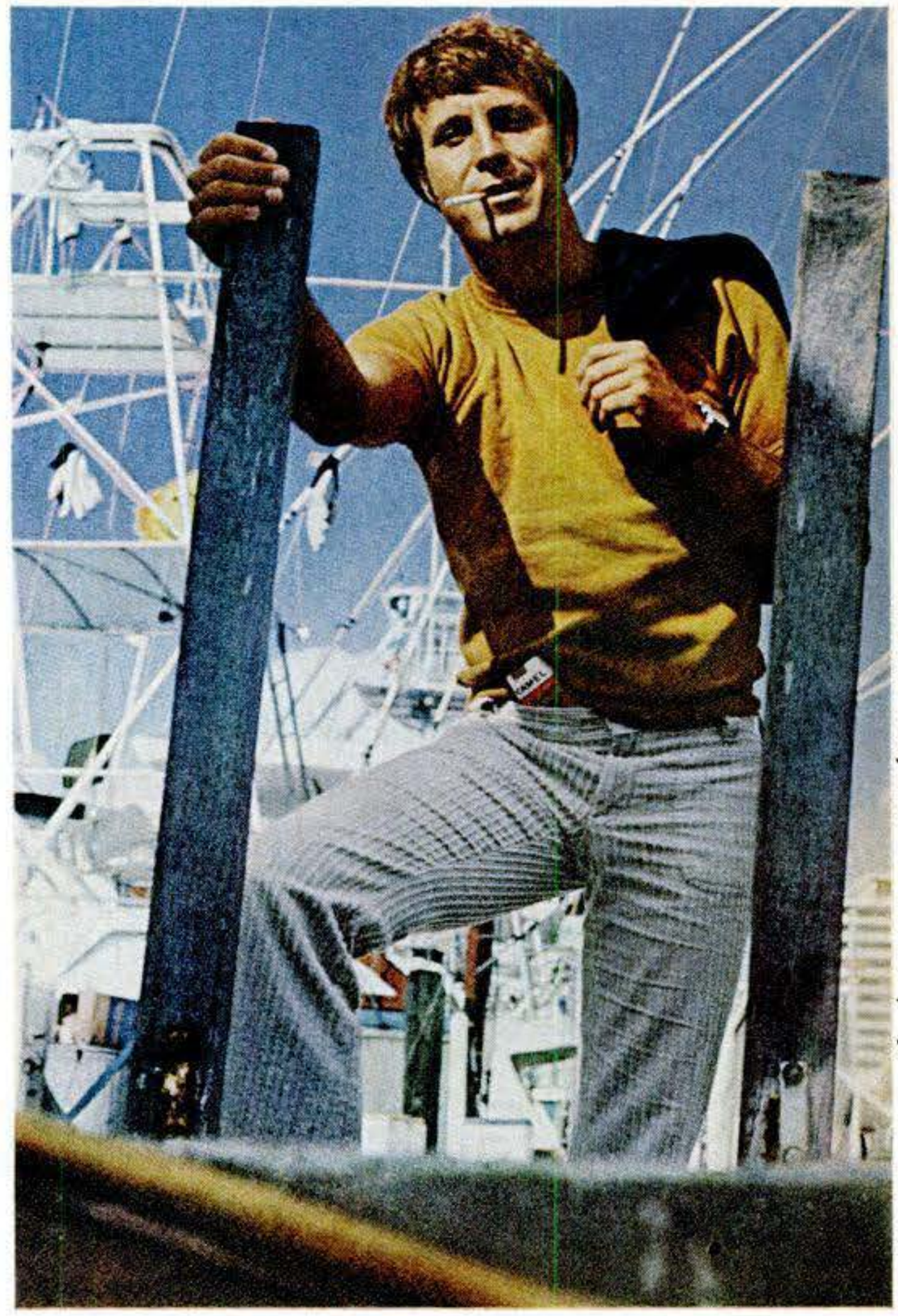
Four mini-pickups (seen top to bottom): brand-new Datsun PL620, Toyota Hi-Lux, Chevrolet L.U.V. (Light Utility Vehicle), Ford Courier. All are made in Japan—Courier by Mazda (Toyo Kogyo), L.U.V. by Isuzu (partly owned by GM).

The latest craze on Muscle Beach is to show off your puffing strength with the new tasteless cigarettes.

Now everybody will be showing off their strength by puffing new tasteless cigarettes



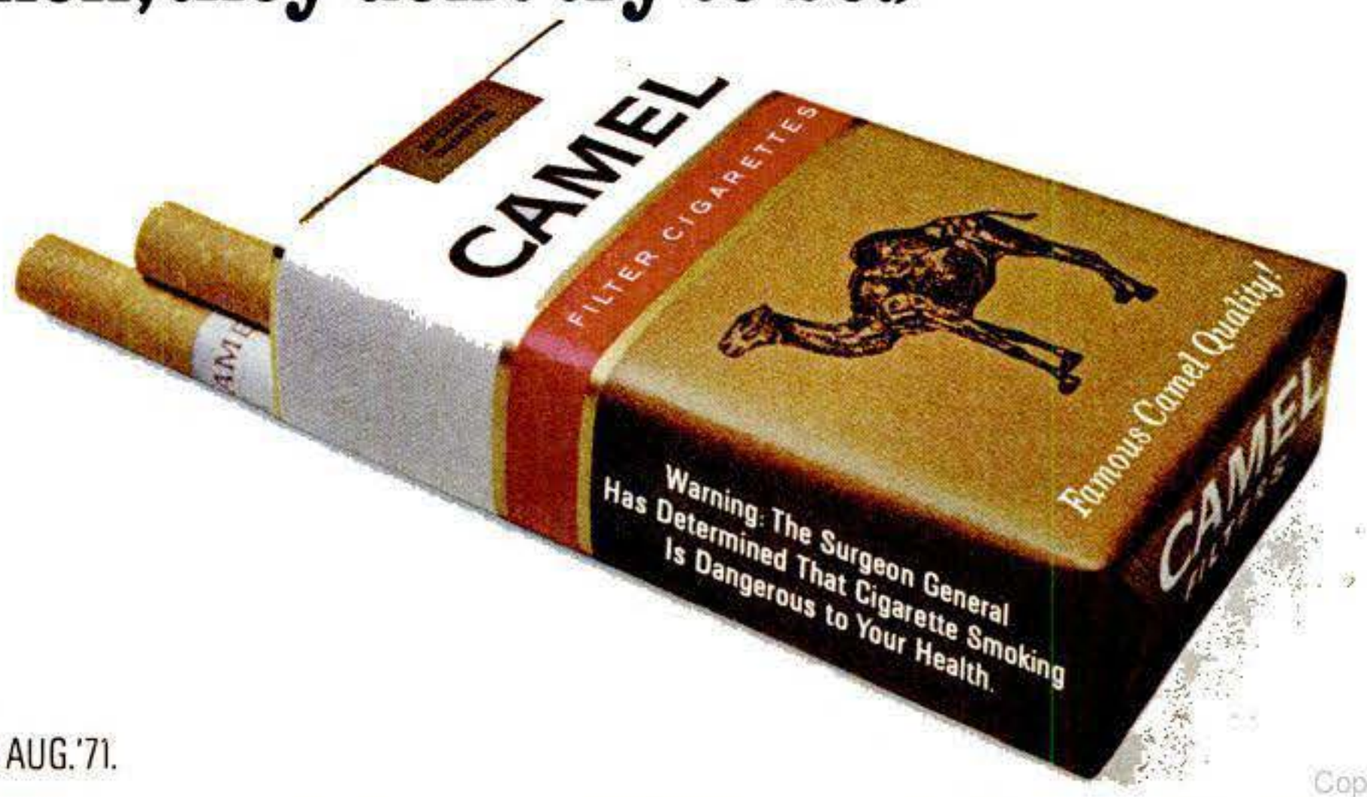
...almost everybody.



©1972 R. J. Reynolds Tobacco Company, Winston-Salem, N. C.

Camel Filters. They're not for everybody.

(But then, they don't try to be.)



20 mg. "tar," 1.3 mg. nicotine av. per cigarette, FTC Report AUG.'71.

Copyrighted material

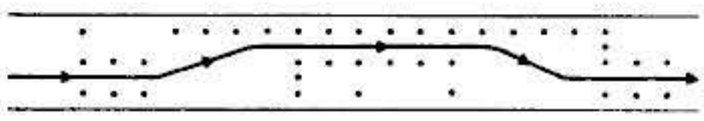
How comparable vehicles have fared in our tests

CAR	CHEVROLET Super 20	CHEVROLET El Camino	CHEVROLET Blazer	DODGE Adventurer 100 SE	FORD Ranger F-250	FORD Ranchero	FORD Bronco	INTERNATIONAL 1000-D	INTERNATIONAL 1210	INTERNATIONAL Scout	JEEP Wagoneer	JEEP Jeepster Commando
Accel. 0-60	13.35	9.0	17.85	11.5	14.9	7.5	15.35	14.0	13.6	14.2	15.05	13.6
Accel. 0-80	23.6	15.4	36.0	23.65	28.45	12.0	32.4	24.8	26.8	32.0	32.1	32.0
Accel. 25-70	16.2	9.9	21.2	12.9	17.95	7.9	18.6	16.6	17.35	18.8	20.0	18.1
Brakes (hot) 60-0	162.3	204.0	162.0	186.6	173.5	150.3	252.8	209.5	150.0	156.0	241.0	164.3
Lane change (mph)	56.3	58.8	49.9	53.0	54.5	53.6	56.3	53.6	56.3	53.0	49.9	57.5
Slalom (mph)	25.7	22.2	25.0	23.9	25.0	27.6	25.7	21.4	23.3	23.6	22.7	26.0
Noise (60 mph)	74 dbA	—	78 dbA	71 dbA	74 dbA	—	82 dbA	—	74 dbA	82 dbA	75 dbA	—
Fuel mpg (45 mph)	11.18	10.7	12.7	13.45	11.52	7.7	12.7	8.9	10.65	14.7	14.6	12.2
Price	$5,216	$3,614	$4,577	$4,696	$5,483	$3,582	$6,882	$4,224	$4,284	$3,880	$5,946	$3,988

How PS tests cars—and what the tests show

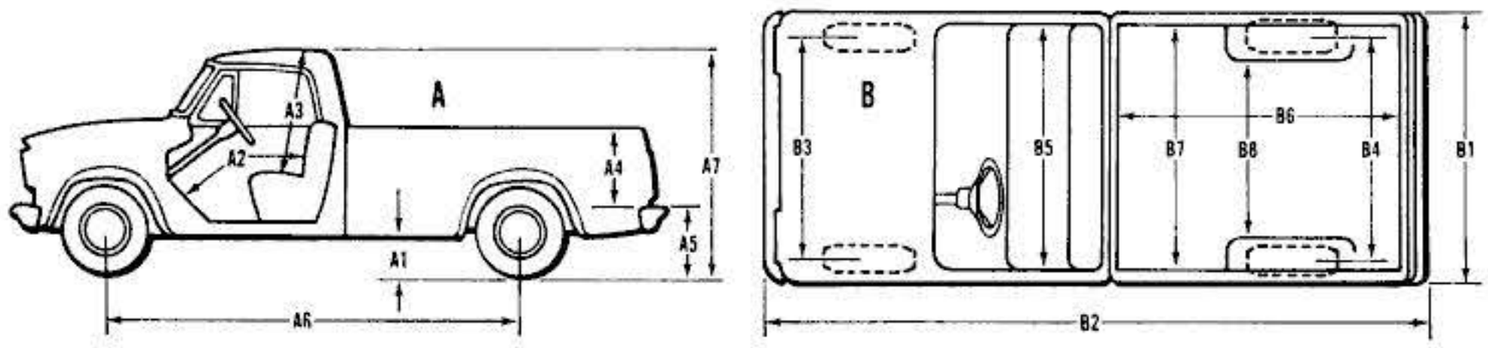
Brake test shows a car's ability to stop from 60 mph without wheel locking. Test is first made with cool brakes, then repeated after 10 warmup stops from 60 at one-minute intervals with 0.5g deceleration. First test shows braking capacity, balance; the second, fade. Excessive pedal pressure indicates fade. Excessive distance indicates fade, incipient or partial locking, or combination of both.

Acceleration test at 0-60 mph shows a car's ability to reach cruising speed from standstill. The 0-80 mph test shows its high-speed power reserve; 25-70 mph test simulates a highway merging situation. Cars with automatic transmission are tested in DRIVE.



Two lane changes in quick succession show a car's ability to make an emergency maneuver at speed. Lanes are blocked 120 feet apart, and lane-change gaps are 60 feet long. Each car is put through test at increasing speed until its maximum is established.

Low-speed emergency maneuver test means snaking a car as fast as possible through pylons 48 feet apart. In both handling tests, times clocked by two stopwatches are converted to mph.



DIMENSIONS (inches)	CHEVROLET L.U.V.	DATSUN PL 620	FORD Courier	TOYOTA Hi-Lux
A1 Ground clearance	8.1	7.9	8.0	7.5
A2 Front leg room (max.)	42.25	42.5	42.5	41.0
A3 Front head room	37.25	35.5	37.0	36.5
A4 Cargo-box height	15.5	16.5	16.25	16.1
A5 Cargo liftover height	27.9	28.5	29.0	29.7
A6 Wheelbase	102.4	100.0	104.3	99.8
A7 Height	60.8	60.6	61.6	61.8
B1 Width	63.0	62.6	63.0	63.2
B2 Length	173.4	169.0	172.0	165.9
B3 Front track	52.8	51.25	52.6	50.8
B4 Rear track	51.2	52.0	52.6	50.8
B5 Front hip room	48.0	53.0	53.5	54.0
B6 Cargo-box length	72.8	72.5	75.0	72.8
B7 Cargo-box width (max.)	61.0	60.5	62.25	56.3
B8 Cargo-box width (min.)	39.4	38.25	36.625	38.3
SPECIFICATIONS				
Engine type	SOHC 4-in-line	SOHC 4-in-line	SOHC 4-in-line	SOHC 4-in-line
Displacement (cu. in./cc)	110.8/1,816	97.3/1,595	109.5/1,796	120/1,982
Compression ratio	8.2:1	8.5:1	8.6:1	8.5:1
Carburetion	one 2-bbl.	one 2-bbl.	one 2-bbl.	one 2-bbl.
Net hp @ rpm	75 @ 5,000	81 @ 5,600	74 @ 5,000	85 @ 5,500
Net torque @ rpm	88 @ 3,000	99.8 @ 3,600	92 @ 3,500	104 @ 3,600
Transmission	manual 4-sp.	manual 4-sp.	manual 4-sp.	manual 4-sp.
Axle ratio	4.56:1	4.38:1	4.11:1	4.11:1
Tire make	Yokohama	Bridgestone	Bridgestone	Bridgestone
Tire type	Y-45	6 PR	6 PR	6 PR
Tire size	6.00-14	6.00-14	6.00-14	6.00-14
Turn diameter	34.7 ft.	34 ft.	35.3 ft.	31 ft.
Turns, lock to lock	3½	4	3⅓	3⅓
Brakes	drum/drum	drum/drum	drum/drum	drum/drum
Fuel tank (gal.)	10.0	11.88	11.9	12.1
Curb weight (lbs.)	2,450	2,290	2,510	2,435
Payload capacity (lbs.)	1,100	1,102	1,400	900
Gross vehicle weight (lbs.)	3,950	3,950	3,910	3,840
TEST RESULTS				
Acceleration 0-60 mph	21.4	25.0	21.3	18.25
Acceleration 25-70 mph	28.9	35.15	28.6	25.7
Braking (cool) 60-0 mph	158 ft. 5 in.	120 ft.	146 ft. 6 in.	134 ft.
Pedal pressure	70 lbs.	80 lbs.	100 lbs.	150 lbs.
Braking (hot) 60-0 mph	149 ft. 8 in.	134 ft. 4 in.	140 ft. 10 in.	185 ft. 2 in.
Pedal pressure	90 lbs.	80 lbs.	120 lbs.	160 lbs.
Max. speed—lane change	58.2 mph	59.4 mph	58.2 mph	49.9 mph
Max. speed—slalom	29.1 mph	28.1 mph	27.2 mph	25.7 mph
Gas mileage (constant 45 mph)	22.315 mpg	26.753 mpg	22.766 mpg	25.831 mpg
Basic price (as tested)	$2,515	$2,236	$2,222	$2,222

Up to '72, Datsun—initiator of the whole thing just 10 years ago—had 75 percent of the mini-pickup market. Toyota entered the field in 1967.

The demand then rose so fast that Ford and Chevy could not afford to stay out of the action.

Why not build them here? The Ford Courier is built by Mazda, the Chevy L.U.V. by Isuzu. Wouldn't it have been smarter to make truck versions of the Pinto and the Vega? No, for several reasons. The Vega and Pinto factories are running to capacity, turning out passenger cars. Second, the body structures and rear suspensions do not lend themselves well to truck conversion. It would cost too much and take too much time to develop new mini-pickups.

The answer was to buy them in Japan. Although they fit within the overall dimensions of Japanese economy cars, these little pickups are built like trucks. They have truck-type frames; most small cars, including the Pinto and Vega, have unit-construction bodies. All have leaf-spring rear suspension, like most American pickups. All have independent front suspension—coil springs on the Courier and Toyota, torsion bars on L.U.V. and Datsun.

You can expect two more entries next year: Mazda will introduce its own version of the Courier (with a smaller engine), and Dodge will import a Mitsubishi pickup (using the Colt power train).

Thinking small. The mini-pickup is a uniquely Japanese phenomenon. Which one sells best at home? Datsun has about 60 percent of the small-truck market, Toyota has 30 percent, and the remainder is split about evenly among Isuzu, Mazda, and Mitsubishi.

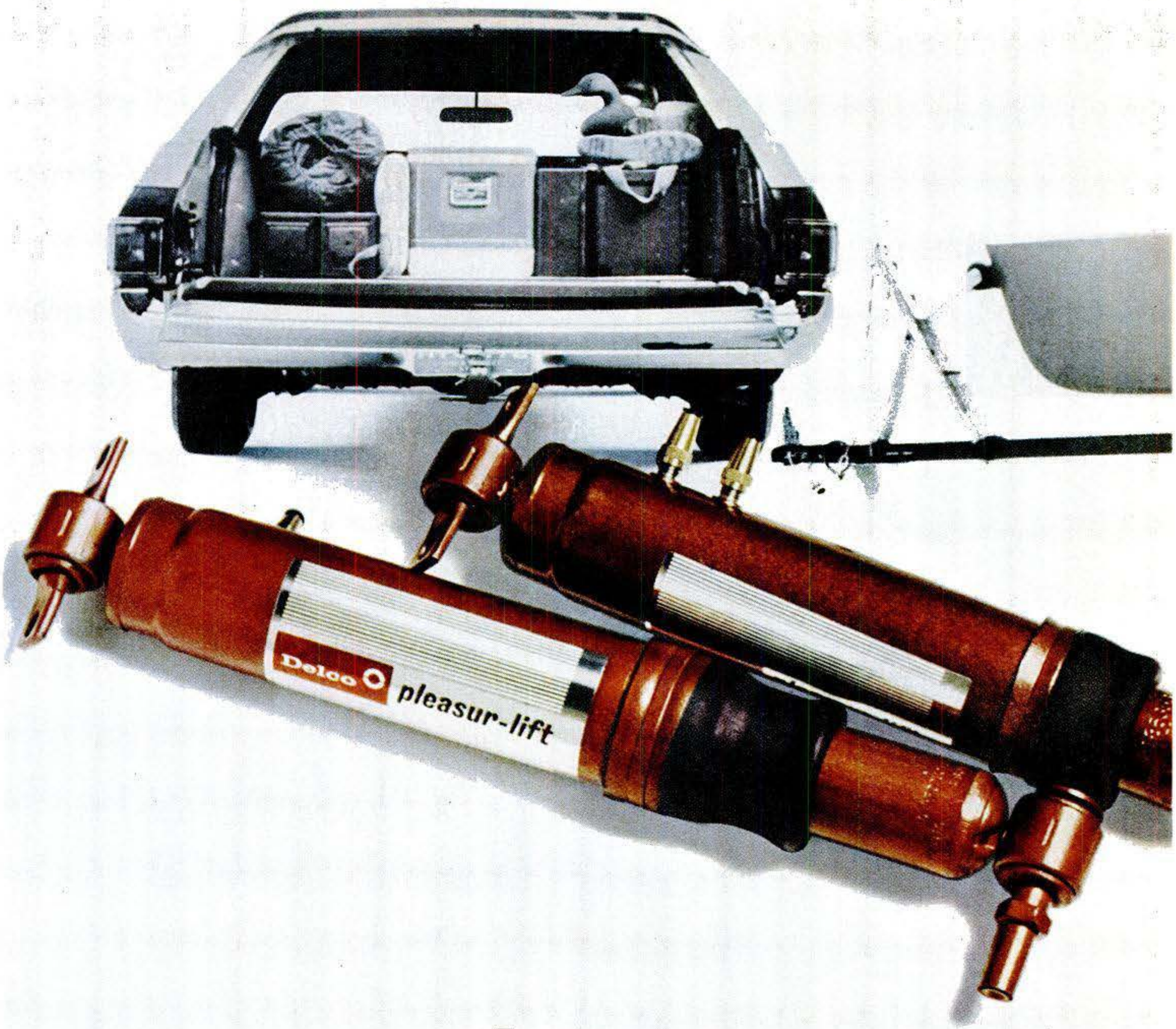
All have a clean, modern appearance, with complete freedom from styling frills. Tight bodies, well-finished cabs, good materials, and close fit everywhere attest to their high quality.

Not all passenger-car safety standards apply to these bantam trucks. They are equipped with seat belts, but not buzzers. Except for the Datsun, ignition keys go into locks on the dash and do not lock the steering column. Bumper standards do not apply. Datsun has a flush-fitting rear bumper which surrounds the taillights, but the others list rear bumpers as optional.

The engines are among the most modern designs going. All are quiet, efficient four-cylinder jobs with single overhead camshafts. They have adequate power to give satisfactory acceleration with a 440-pound load and two men aboard. They also give very

Continued

Copyrighted material



Are you handling your load, or is it handling you?

If you equip your car with Delco Pleasur-lifts, there's no question about it.

Because Pleasur-lifts will help keep your car at a level attitude, even with heavy loads in the rear. Pleasur-lifts are the air adjustable shock absorbers from Delco. They allow you to control the height of your car's rear bumper. They help keep your headlights aimed level, too. Even if you're towing a trailer.

From a single easy-to-reach fitting in the trunk of your car, you control the pressure in a special chamber in both Pleasur-lifts. Pump them up to meet a load, let them down for normal driving. Quick and simple. And you're in charge.

To really know the advantages, you'll have to try it.

So we make you this offer.

Get a set of Pleasur-lifts from a participating Delco dealer and drive on them for 90 days. If you're not satisfied, you can have your money and your old ride back.

The more you know, the more you'll want Delco.

Your Delco dealer has Pleasur-lifts to fit most cars. He can also show you a special attachment that allows you to operate the Pleasur-lifts from your dash—even while the car is moving.

Put Delco Pleasur-lifts on your car, and show that load who's boss.

Delco GM

Copyrighted material

Do unto metal as you've done unto wood.

Welding's fun. Make wrought-iron furniture. Sculpt something. Fix the unfixable.

This welding, brazing, soldering and flame-cutting Handicrafter outfit makes metal about as easy to work as wood.

It comes complete with oxygen and fuel-gas regulators, welding torch, cutting, heating and welding tips, tip cleaner, goggles, cylinder wrench and hose. All for $135.

From Airco Distributors. Almost everywhere. In the Yellow Pages under "Welding Equipment and Supplies". Also ask to see our economical Minicrafter for $77.

Please send me information on Handicrafter and a free copy of your 24-page manual, "Basic Welding for Craftsmen."

Name_____

Address_____

City_____

State_____ Zip_____

AIRCO
Welding Products

Box 486, Union, N.J. 07083

Cargo boxes hold 35-40 cubic feet. Courier (center) has largest; Toyota's (bottom) is smallest. L.U.V. and Datsun (top, left and right) come in between. Boxes have single-wall construction only. Tailgates have latches at both sides that must be opened and closed separately.

good fuel economy—22-27 mpg—with the same load.

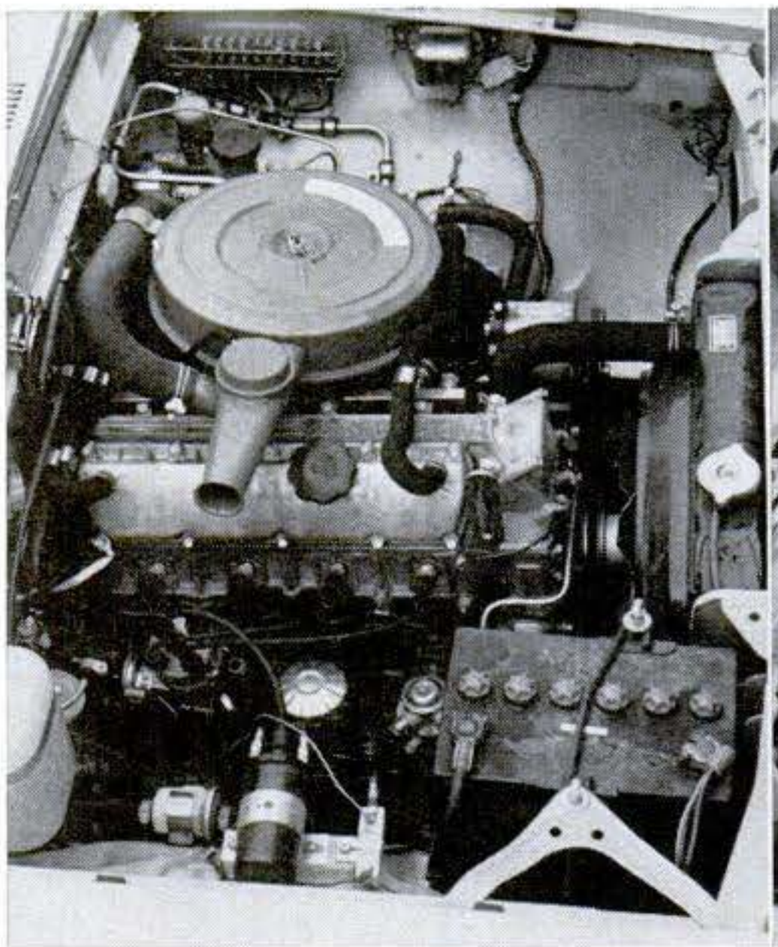
And drivability is excellent. The engines start instantly—hot or cold—idle smoothly, do not stall or run on. They behave just as American engines used to before emission controls were required. Yet these trucks have controls, including evaporation-storage canisters.

They are geared to allow use of top gear in city traffic (right down to 25 or 30 mph), yet they are quite willing to rev. Top speeds are 85 to 90 mph, and the pickups can all cruise at 70-75 with moderate noise levels. The Toyota and Datsun have automatic choke (manual on L.U.V. and Courier). The Datsun alone is planning to offer an optional automatic transmission.

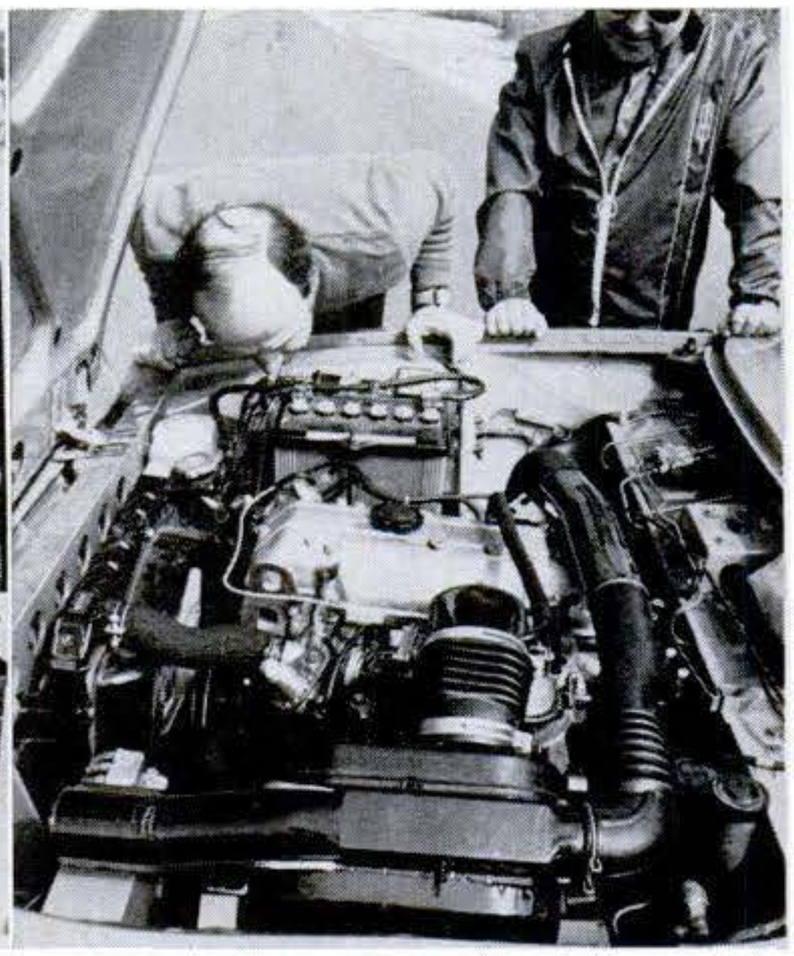
Braking the load. The Datsun and L.U.V. have power brakes as standard, and consistently lower pedal pressure. Disk brakes are not available on any of these trucks. The drums are sized for safe stops from top speed with full load, and the friction materials selected have reasonable fade resistance.

Stopping distances were short, whether the brakes were hot or cool,

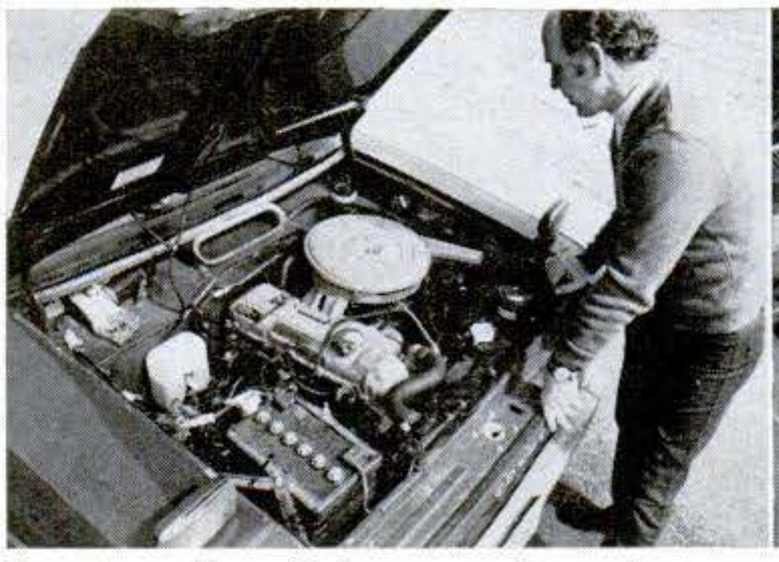
Continued



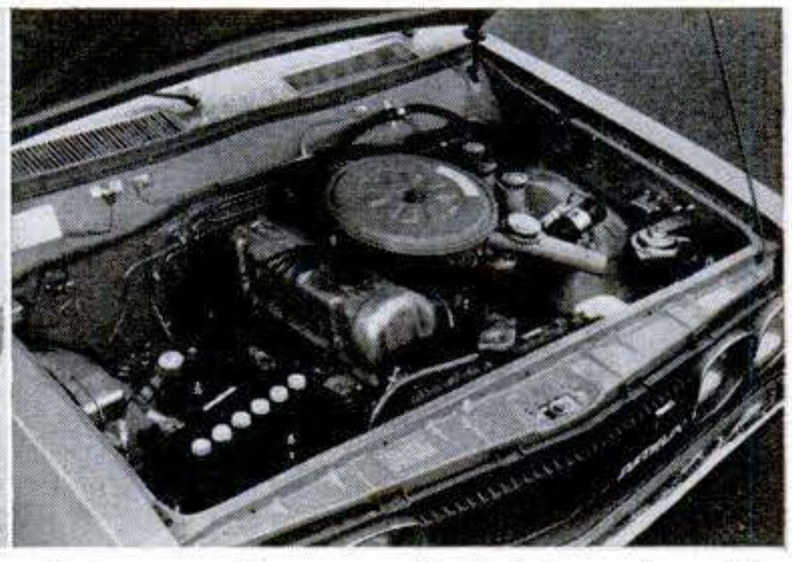
L.U.V. engine offers easy access to all points that need periodic servicing.



Courier engine: Oil-filter change may be tricky; otherwise it's easy to work on.



Toyota engine: Maintenance is made easy by clear access to all service points.

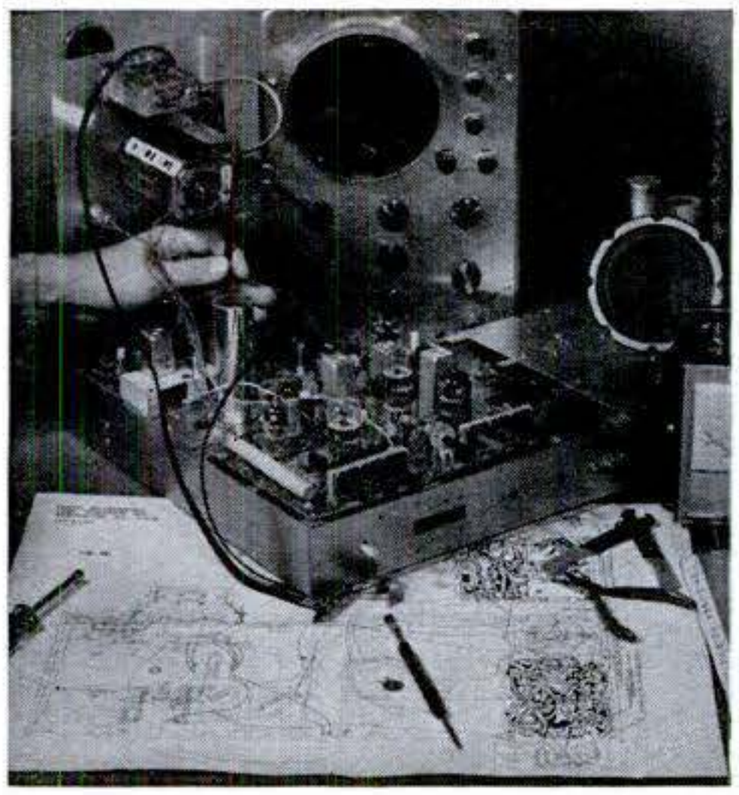


Datsun engine, canted slightly to the right, invites you to do your own upkeep.

Copyrighted material

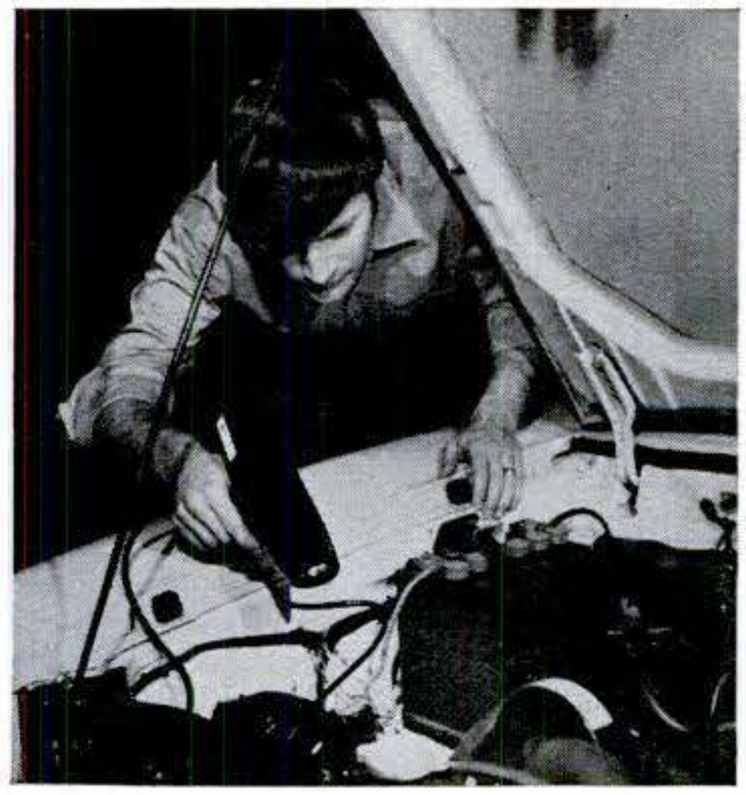
3 needed skills NRI can teach you at home

NRI courses use "bite-size" texts to show you how to service TV-Radios, Repair Cars or Appliances



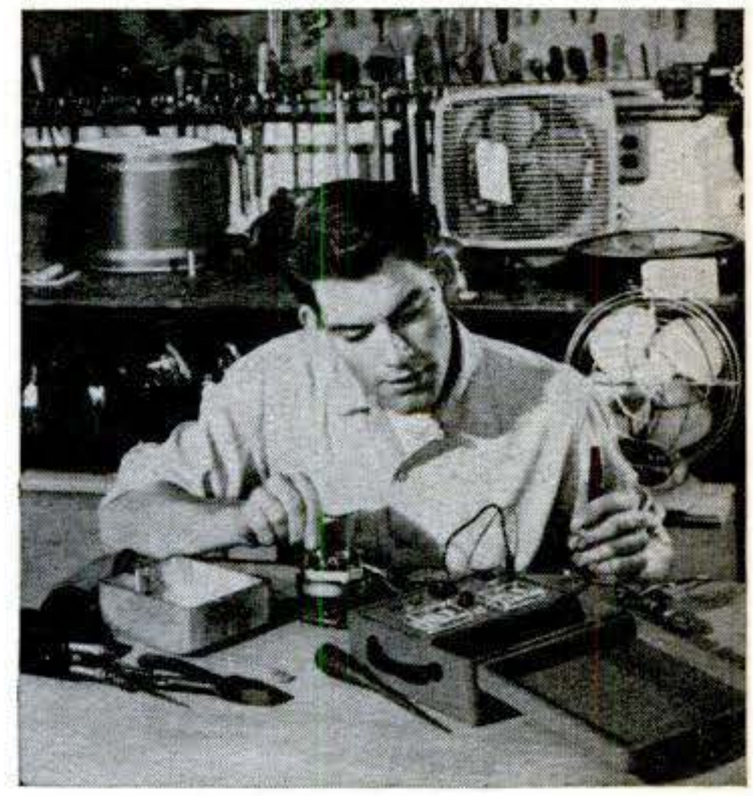
TV-Radio Servicing

The NRI TV-Radio Servicing course includes your choice of black and white or color TV training equipment. NRI courses cover FCC license preparation, complete communications electronics, aircraft electronics, mobile communications, marine electronics, amateur radio, industrial and business electronics.



Automotive Repair

Take your choice of Master Automotive Technician training or a shorter Automotive Tuneup and Electrical Systems course for the man seeking greater understanding of basic car repair. Both courses include professional equipment so that you get "hands-on" experience and the chance to earn spare-time money making repairs.



Appliance Repair

NRI trains you to fix all kinds of electrical appliances, plus air conditioners, refrigerators, house wiring, electric motors, even small gas engines. An appliance tester is included for fast trouble shooting, so you can begin earning money repairing appliances long before you finish the course.

"Hands-on" training pays off

NRI was the first to supply home study students with custom-designed training kits to give practical hands-on experience as you learn. You get more value from the exclusive Achievement Kit sent the day you enroll, to "bite-size" texts and training equipment. Learning TV-Radio, Automotive Servicing and Appliance Repair at home is easy, exciting, the simplified, dramatized NRI way.

Earn $5 to $7 an hour spare or full time

Tens of thousands of NRI graduates are proof it is practical to train at home in your spare time. Keep your present job while preparing for a better one and earn $5 to $7 an hour extra in your spare time.

Fix your own equipment, or earn money making repairs for friends and neighbors. NRI shows you how.

Train with the leader—NRI

The same training innovations which have made NRI the leader in career training at home is now available to you. Let NRI help you step up to better pay, a brighter future. Decide now to move ahead . . . the decision is yours to make. Mail the postage-free card today for a free full-color catalog in the field of your choice. No obligation. No salesman will call.

NRI TRAINING
3939 Wisconsin Avenue
Washington, D.C. 20016

Copyrighted material

Stopping at 200 mph

or 65 mph

it's all the same to GREY-ROCK® Brake Lining.

Grey-Rock brake lining has a punishing job — to slow and stop moving vehicles. It does its job well.

School buses depend on it. The racing fraternity swears by it. It's the preferred brake lining for off-highway equipment and the heaviest trucks on the road.

It stops them. It'll stop *you.* Safely and surely. Next time don't just say "Replace the brakes." Say "Be sure it's Grey-Rock."

GREY-ROCK®
BRIDGEPORT CONN. 06603
DIVISION OF Raybestos Manhattan

Toyota in brake test: average instability, but least fade (overheating) resistance.

L.U.V. in brake test: stopping distance dropped after warmup; pedal pressure up.

Courier in brake test: impressive fade resistance, about average instability.

Datsun in brake test: shortest stopping distance, minimal fade after warmup.

but all had brake-balance problems. All suffered premature rear-wheel locking (with 440-pound loads), with resulting loss of stability. They slue right and left, calling for constant steering corrections. Nor are the front brakes fully stable; drum brakes have a self-energizing effect, which is rarely equal in the two wheels and therefore produces a pull to one side. (We're getting so used to disk brakes that we tend to forget how bad the drum brakes were!)

Driver comfort? All four trucks have quite civilized cabs. The Datsun has ventless door glass, and the others have vent windows. All have fresh-air intakes, and efficient heater and defroster systems with quiet two-speed fans. All have interior hood locks, and the Courier and L.U.V.

Continued

Courier in lane change tied for second fastest time with L.U.V., but had lighter steering, same amount of body roll.

Toyota in lane change was the slowest by far. It loses steering precision at high speeds, and has very heavy steering.

L.U.V. in lane change ran as fast as the Courier, but had a tendency to lift the inside rear wheel on sudden turns.

Datsun in lane change was the fastest, and practically free of body roll. All trucks carried 440-pound load in test.

Copyrighted material

"Being a good mechanic takes more than knowing how."

"I was trained as an aircraft mechanic. And believe me, they teach you to *care* about what you do," says Mike Todd, of Denver, Colorado.

"The truth is, they've always stocked Champions at the garages and service stations where I work. And they are a good plug for any car.

"I run my Chevy El Camino with Champions and I think it runs better with 'em.

"It's as simple as that."

DEPENDABLE CHAMPION SPARK PLUGS

Toledo, Ohio 43601

7 million Chevrolet owners have switched to Champion Spark Plugs.

Copyrighted material

SPRAY IT ON HOSE IT OFF

GUNK ENGINE-BRITE! . . . grease is turned into a soapy substance that is easily hose-rinsed away. Removes fire hazard! Restores cooling efficiency!

GUNK Engine Brite ENGINE CLEANER QUICKLY REMOVES GREASE AND GRIME 16 AV. OZ.

In squirt cans or spray cans.

G-P GENERAL PURPOSE DEGREASER GUNK G-P (liquid) cleans power mowers, garage floors, machinery.

GUNK BO-2K professional carburetor and small parts cleaner for home workshop.

S-C SUPER CONCENTRATE Dilutes with 10 parts kerosene for degreasing at lowest cost.

GUNK LABORATORIES, 5829 W 66th, Chicago, Ill. 60638
GUNK CHICAGO CO. River Forest, Ill. RADIATOR SPECIALTY CO. Charlotte, N. C.

LOOSENS BOLTS & RUSTED NUTS, PARTS in seconds

LIQUID WRENCH is the super penetrating rust solvent that loosens rusted nuts, bolts and parts in seconds . . . safe on all metals . . . even your watch!

Liquid WRENCH THE SUPER PENETRANT FREES RUSTED BOLTS AND PARTS it melts the rust away! DANGER: FLAMMABLE KEEP FROM HEAT OR FLAME HARMFUL OR FATAL IF SWALLOWED CONTENTS UNDER PRESSURE NET WT. 12 OZ. AV. (15 FL. OZ.)

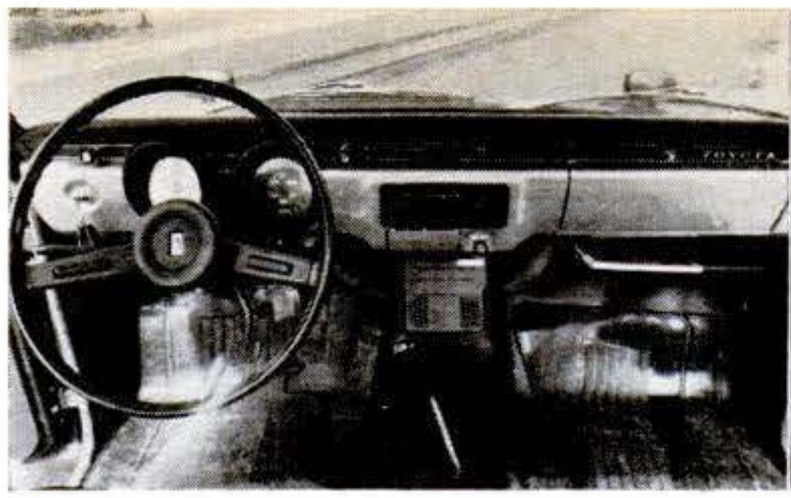
in spray cans or squirt cans.

TRANSEAL stops leaks in automatic transmissions.

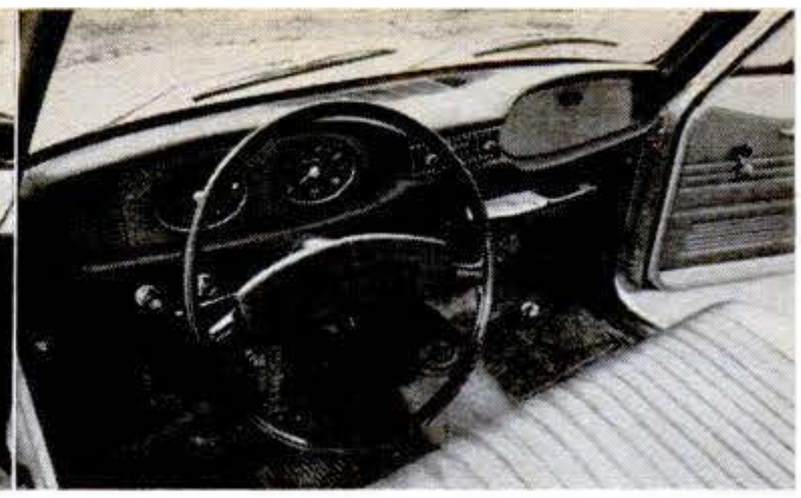
TRANS MEDIC Stops transmission troubles. Eliminates slippage, down-shifting.

LAN-LIN Quickly removes grease, grime, paint, stains.

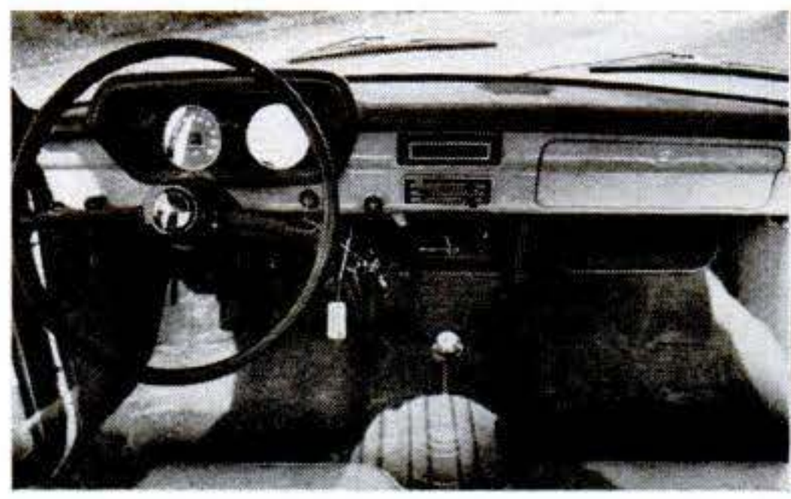
RADIATOR SPECIALTY COMPANY Charlotte, North Carolina 28201



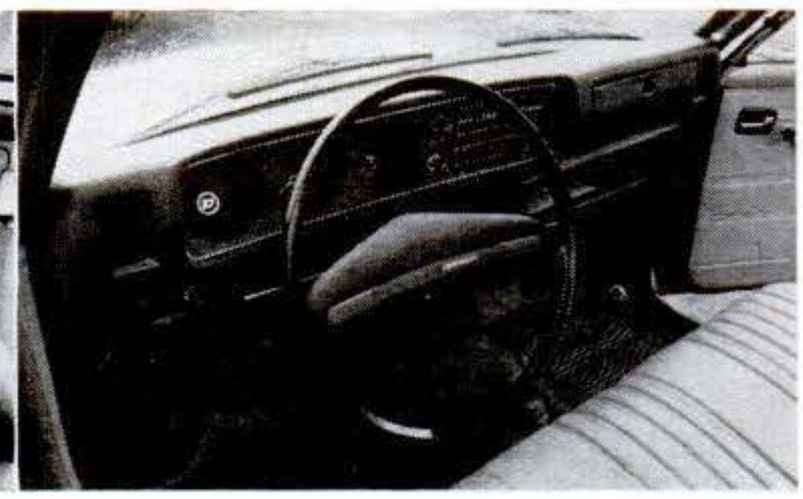
Toyota has easy-to-read instruments and easy-to-reach controls, but cramped space.



L.U.V. oval instruments are weird. Heater controls are hidden if ashtray's used.



Courier combines lights, wiper/washer, and dimmer switch on steering-column stalk.



Datsun has best seating space, most car-like interior, and modern instrumentation.

have front-hinged hoods. You'll find a glove compartment plus storage tray in every one, too.

None of the trucks has a good lever-type hand brake. Even a pedal-type emergency brake with button release on the dash would be preferable to the under-dash knee-menacing umbrella-handle parking brakes used on these trucks.

Spare wheels, held in the frame below the cargo box, are difficult to dismount. Removal and installation are time-consuming. Jacks and other tools are easily reached behind the seat. Bench seats are standard on all.

At night, the taillights of a car ahead are reflected in the rear window of the cab and, in turn, picked up by the inside rear-view mirror. We found it difficult to get used to sudden appearances of red lights in the mirror only seconds after looking back and seeing nothing. Surely it must be possible to arrange reflection angles to eliminate this?

Out on the road. With a load in the cargo box, all the trucks have reasonable ride comfort. Unloaded, they tend toward choppiness, and on poor road surfaces the seat belts (unless you're sitting on them) are of value in keeping your head away from the ceiling. The Courier has the best ride, loaded or unloaded. Next is Datsun, then L.U.V. Last, Toyota.

On the turnpike, we found that each truck had a drive-line boom in certain speed bands. This is caused by unbalanced forces in the four-cylinder engines, amplified at certain frequencies in the drive line, then setting up vibrations in the cab. In four-cylinder cars, the drive-line boom is usually filtered out by insulation, but apparently the makers felt that it wasn't necessary for the trucks. The only thing you can do is avoid cruising at the speeds where it occurs. Or live with it.

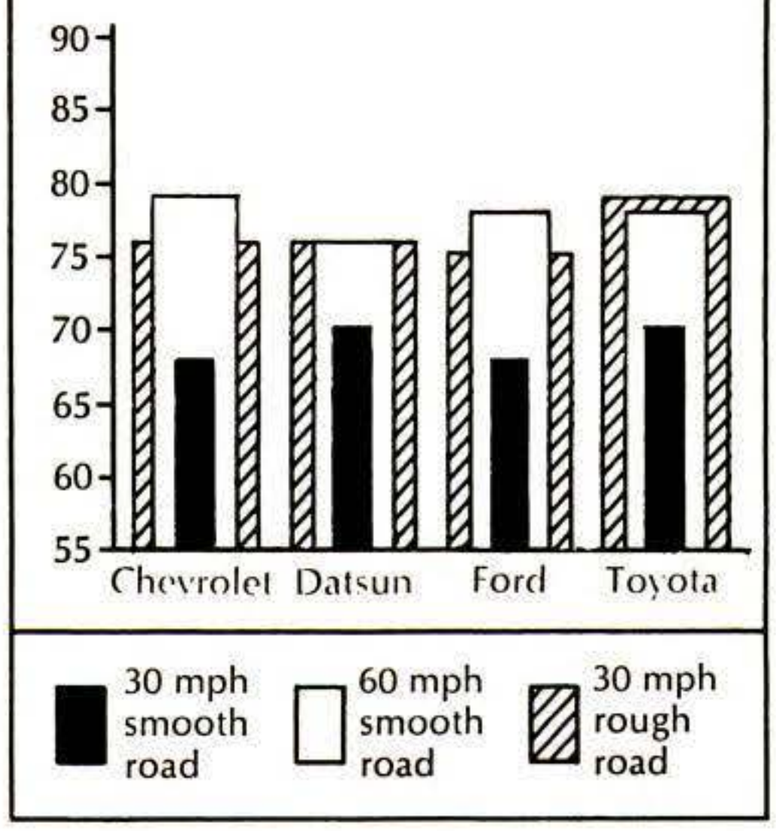
Conclusions

Dunne: The Courier would be my choice. It has the best ride comfort, the driving position is not too cramped, and the payload capacity is outstanding.

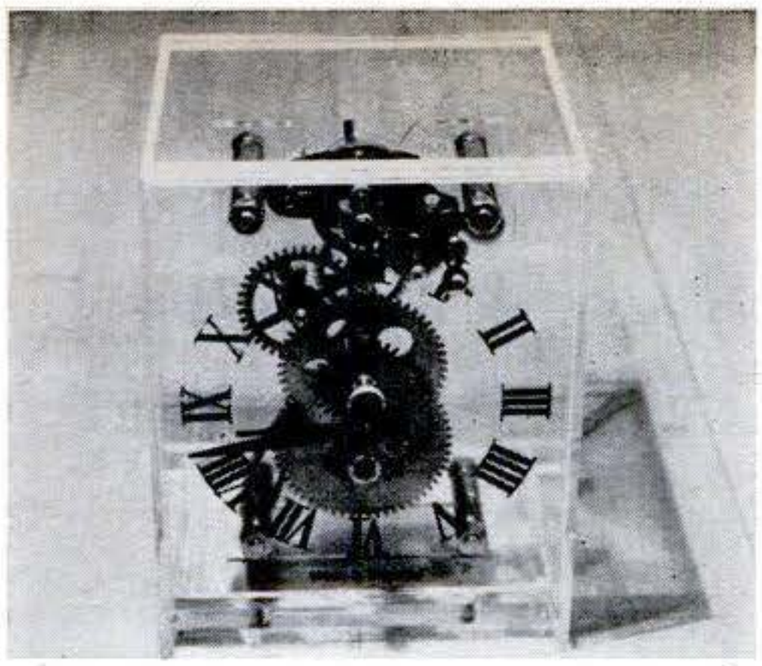
Norbye: The Datsun has better brakes and better gas mileage, but is down on power. I think I would buy the Courier, too. PS

NOISE-LEVEL TESTS

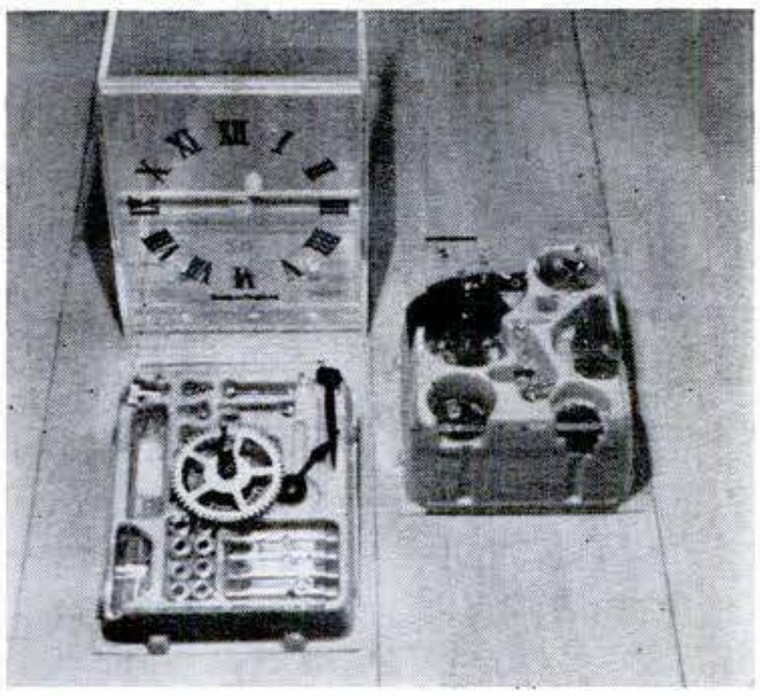
We measure interior noise in decibels under three sets of conditions, on three different scales. For quick reading of the results, we give you only the A-weighted scale, which is most like human hearing in overall sound pickup. A decibel difference of one or two points is perceptible to a driver; five points make enormous difference.



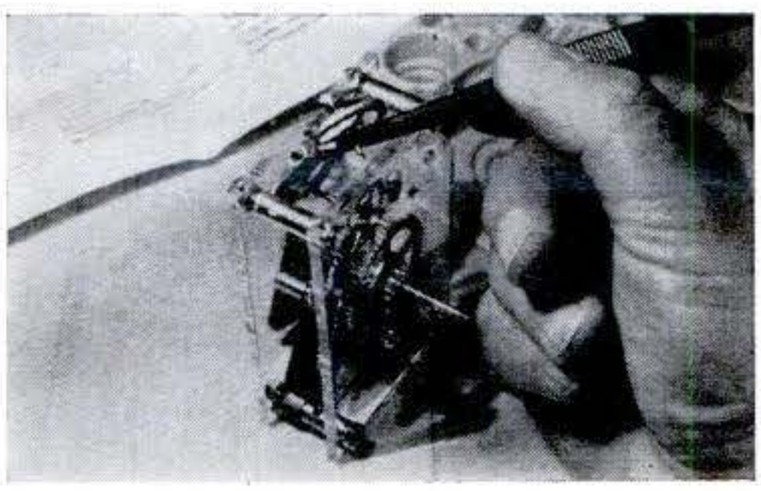
Copyrighted material



Transparent case of Thwaites & Reed kit clock lets you watch the machinery work.



Kit looks like this when you get it, with parts held in two fitted plastic trays.



Fussiest bit is inserting balance-wheel assembly without damaging the hairspring

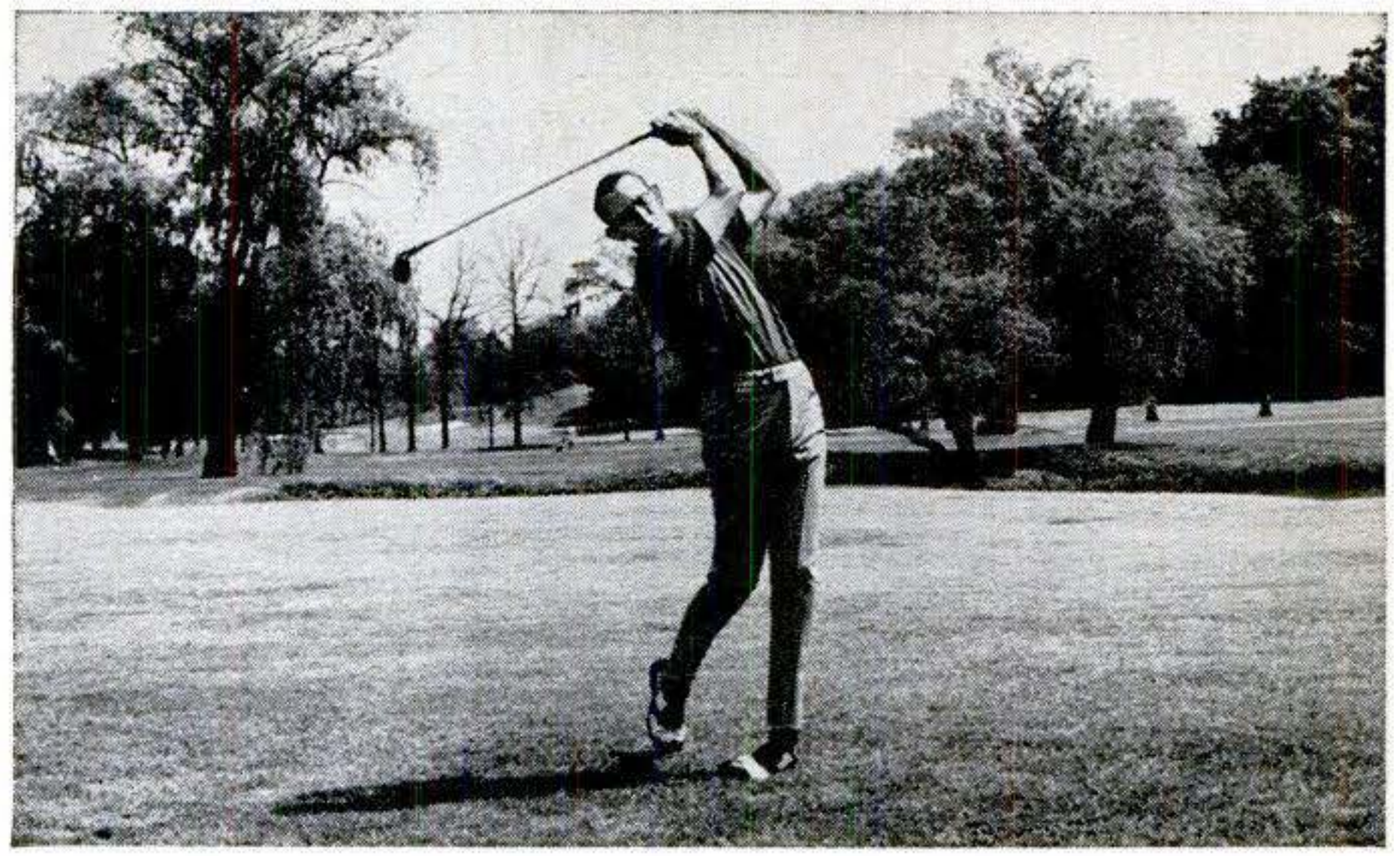
PERSONAL-USE REPORT

See-Through Kit Clock

Got a steady hand? That, plus a screwdriver, tweezers, and pliers, is all you need to build this handsome English 24-hour clock with transparent plastic case.

Most of the assembly is simple, and the plastic case comes ready to go. Two fussy steps are inserting the balance-wheel and pallet assemblies. Easy does it, lest you boing the hairspring. The clock is a good timekeeper, but it does have a loud tick. Abercrombie & Fitch (8701 69th Ave., Forest Hills, N.Y. 11375) sells 'em for $19.45 ppd.—*E. H. Ortner*

You'd drive the ball farther if you could slow down your swing.



A Minolta Autopak®, with its variable filming speed feature, can show you—in excruciating slow motion — what everybody's been telling you is wrong with your swing.

But that's just the beginning. With the Autopak's unique features and system of accessories, you can create cartoons out of children's drawings, or make a rose seem to bloom in two minutes.

No matter what the scene, an Autopak gives you the correct exposure automatically, instantly.

Minolta Autopak-8 cameras start at around $182, plus case, with optical-glass Rokkor zoom lens. Accessories extra.

For literature, write Minolta Corporation, 200 Park Avenue South, New York, N.Y. 10003. In Canada: Anglophoto Ltd., P.Q.

Start to see life differently with a Minolta Autopak.

Is your son ready for a full size .22 air rifle?

This new single-shot pellet rifle is great for indoor target practice and outdoor plinking. It's 40″ long, with a real hardwood stock, a rifled steel barrel, an automatic safety, a grooved forearm for easy pumping and a receiver that takes a telescopic sight. Velocities are variable to over 600 fps. It has the kind of Smith & Wesson precision that lets you make dime-sized shot groups at 33′. And your son can fire away all day for less than ½¢ a round. Best of all, it's a full-sized Smith & Wesson for just $42.50. Is your son ready for it?

Smith & Wesson
Springfield, Mass. 01101

Copyrighted material

Latest U.S. Government figures show

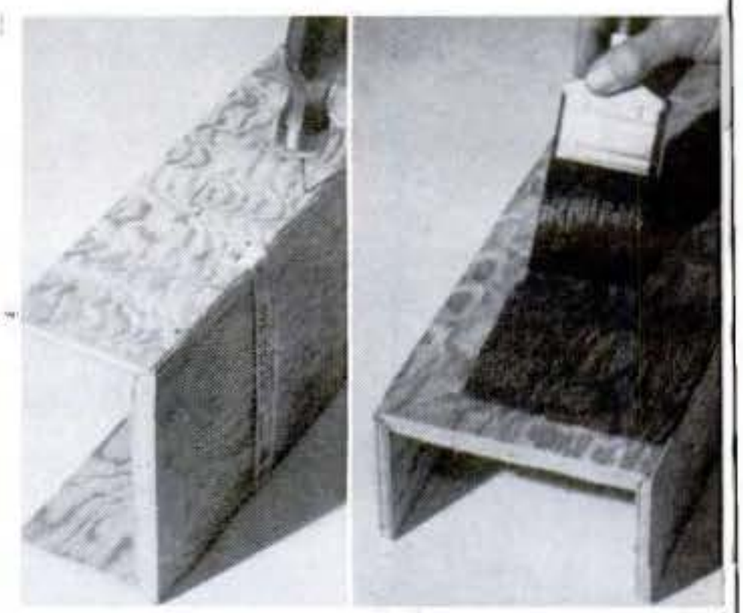
PALL MALL MENTHOL 100's

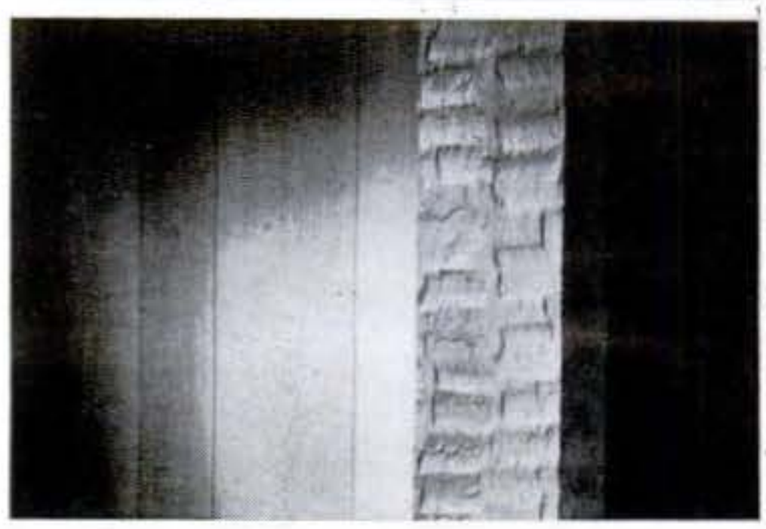
lower in 'tar' than the best-selling menthol king!

Yes, longer...yet milder

PALL MALL MENTHOL 100's..."tar" 18 mg.—nicotine, 1.3 mg.
Best-selling menthol king....."tar" 19 mg.—nicotine, 1.4 mg.
Of all brands, lowest....."tar" 1 mg.—nicotine, 0.1 mg.

18 mg. "tar" 1.3 mg. nicotine av. per cigarette, FTC Report APRIL '72.





Installation is easy: First, unfold the plywood planks (top). Next, nail the pieces together (center, left) and paint or stain the wood (center, right). Finally, nail the finished piece to a wall strip.

Liven Your Den with Hand-Hewn Beams

Here's a neat way to give your walls or ceiling a "solid timber" look—complete with adze marks—at a reasonable price.

Each timber is actually made from three plywood planks. The edges are pre-mitered for easy assembly into a hollow U-shaped beam.

After you nail the beam together you can stain or paint it to play down the fir grain. Then just nail the finished beam to one-inch-thick wall or ceiling strips.

The beams sell for less than a buck a linear foot and come in four sizes. Plank lengths are eight to 16 feet long (in two-foot increments). They're made by U.S. Plywood-Champion Papers Inc., 777 Third Ave., N.Y., N.Y. 10017—*Doug Garr*

Copyrighted material

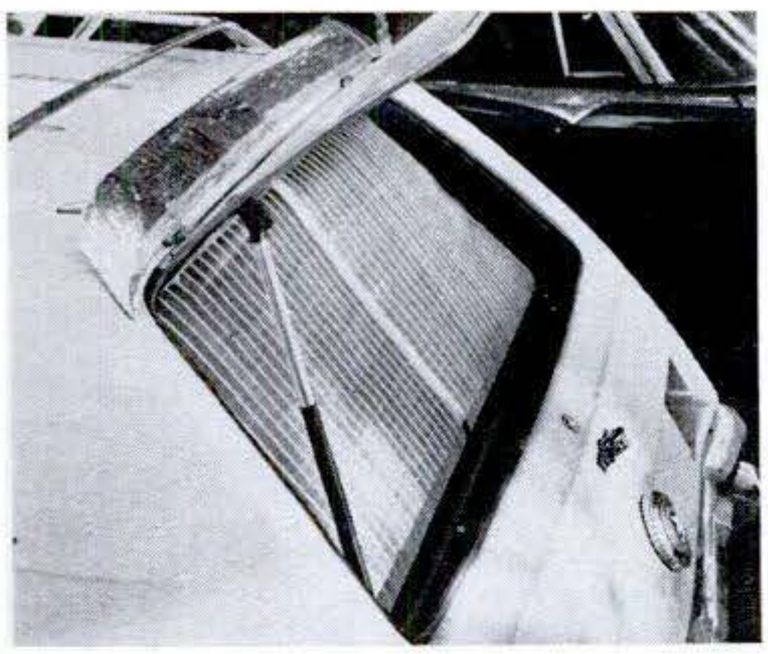
Cool Window Shade for Your Car

On hot days, even with your air conditioner on, the rear passenger area can get overheated from sun through the rear window. All it takes to cool things down is a $12.50 sun screen from J. C. Whitney and Co. (1917-19 Archer Ave., Chicago).

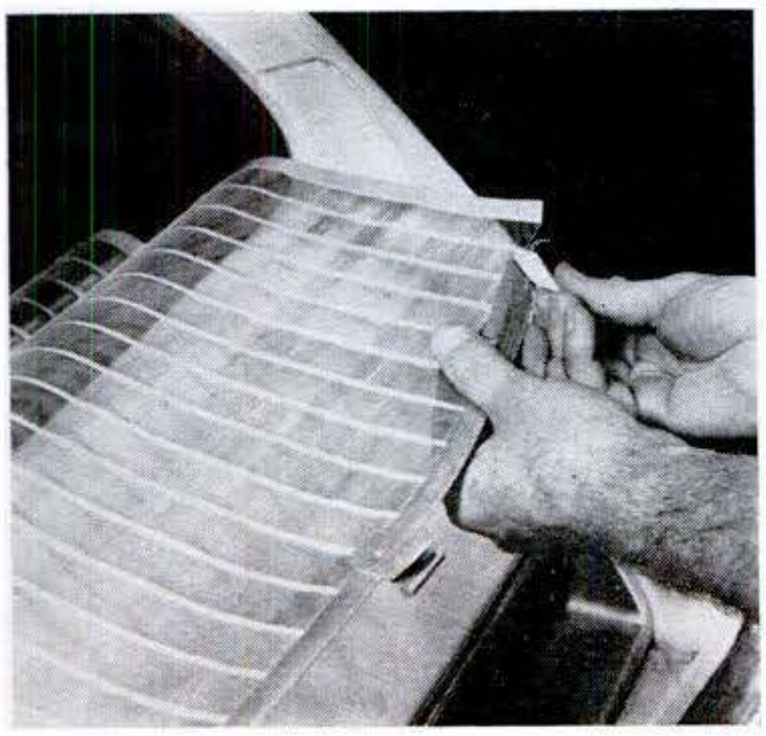
The screen coils onto a spring-loaded roller, like a window shade, except that the roller is at bottom. During a 2,500-mile trip, the screen kept rear passengers comfortable, even when sun exposure was severe.

It's easy to install, although I had to stretch it to maximum height to get the roller below the level of the rear-window opening—and then I had to drill holes to accept the telescoping rods that are supposed to hold the roller by tension. Installation time was under an hour, even so.

Screens are available for side windows of station wagons and sedans. They're mounted so the screen rolls downward. Shade prices run from $5.40 to $12.50.—*Frank Butrick*



Sun screen is perforated anodized aluminum. When ordering, be sure you give your car's make, year, and model number.

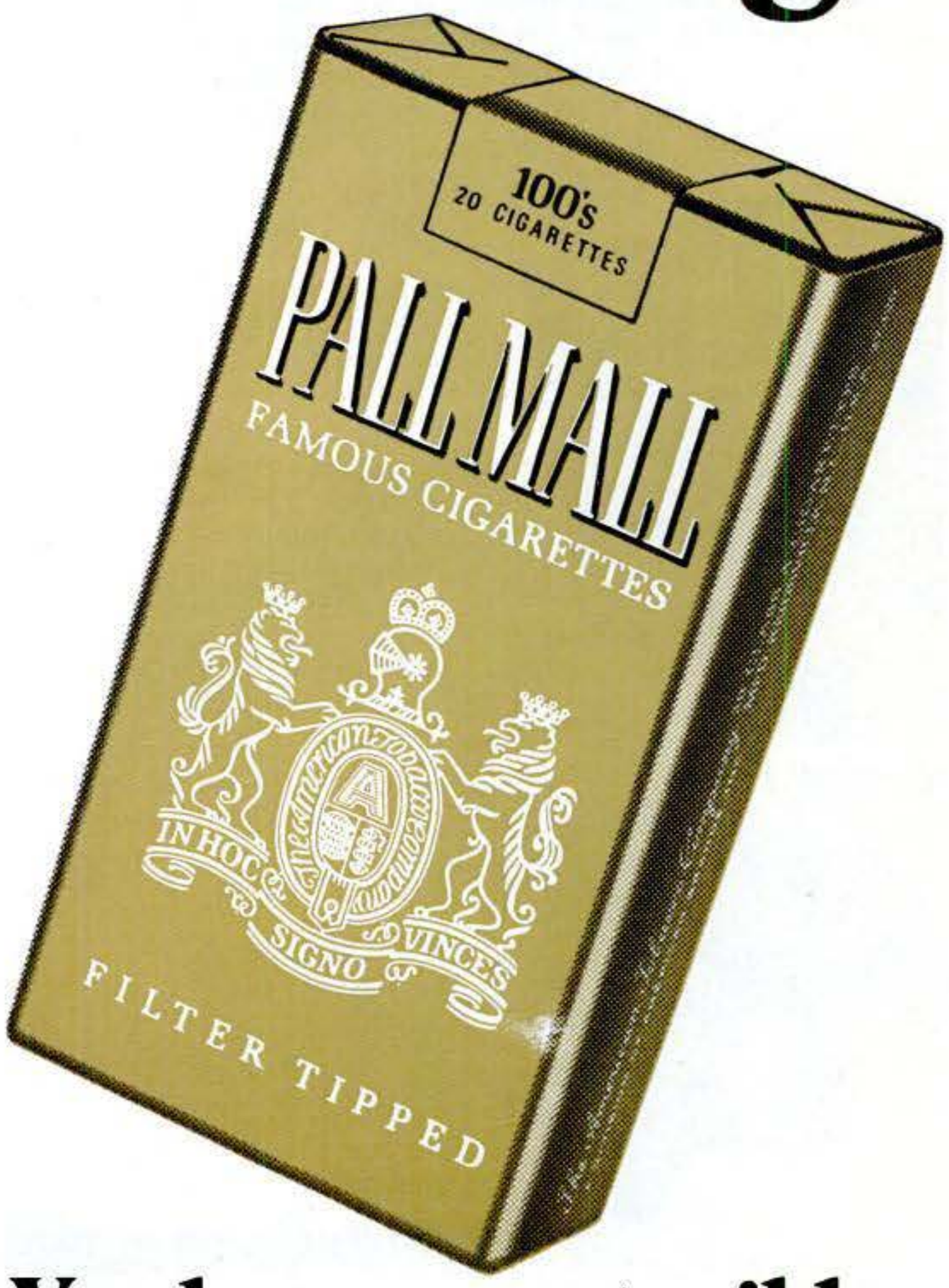


To improve the fit, you may have to use tin snips to round off corners. The screen won't cover the slanted sides of windows.

Latest U.S. Government figures show

PALL MALL GOLD 100's

lower in 'tar' than the best-selling filter king!



Yes, longer...yet milder

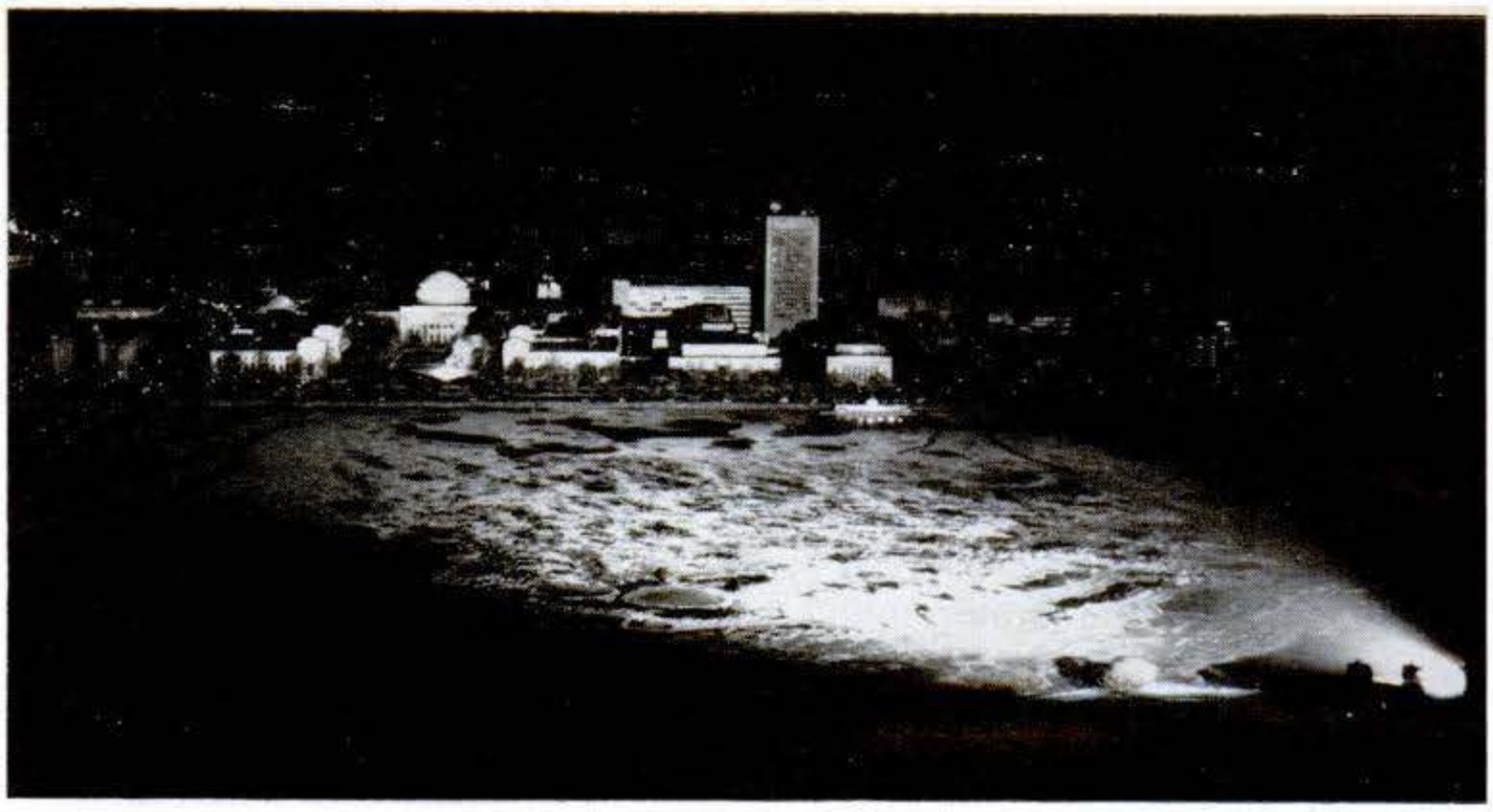
PALL MALL GOLD 100's..."tar" 18 mg.—nicotine, 1.3 mg.
Best-selling filter king....."tar" 20 mg.—nicotine, 1.4 mg.
Of all brands, lowest....."tar" 1 mg.—nicotine, 0.1 mg.
18 mg. "tar" 1.3 mg. nicotine av. per cigarette, FTC Report APRIL '72.

Copyrighted material

Science Newsfront

Last-minute news and notes to keep you up-to-date

By ARTHUR FISHER



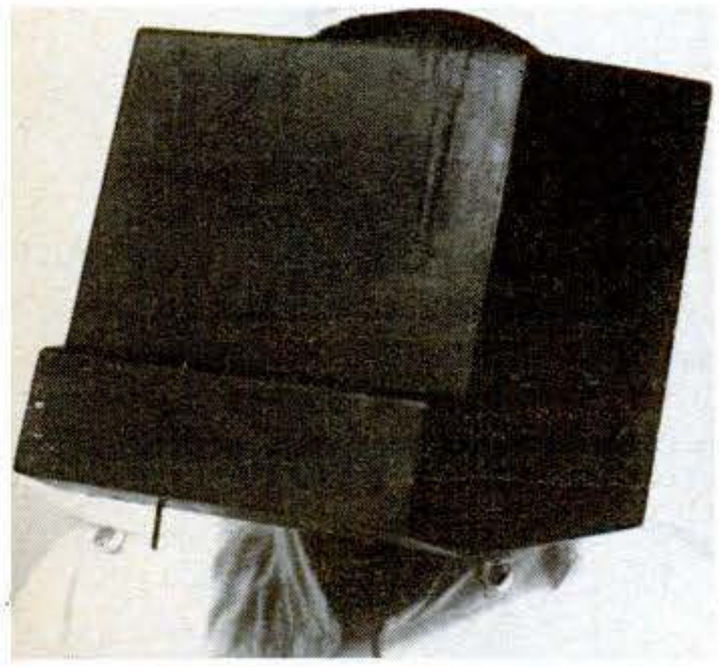
World's most powerful flash lights up MIT

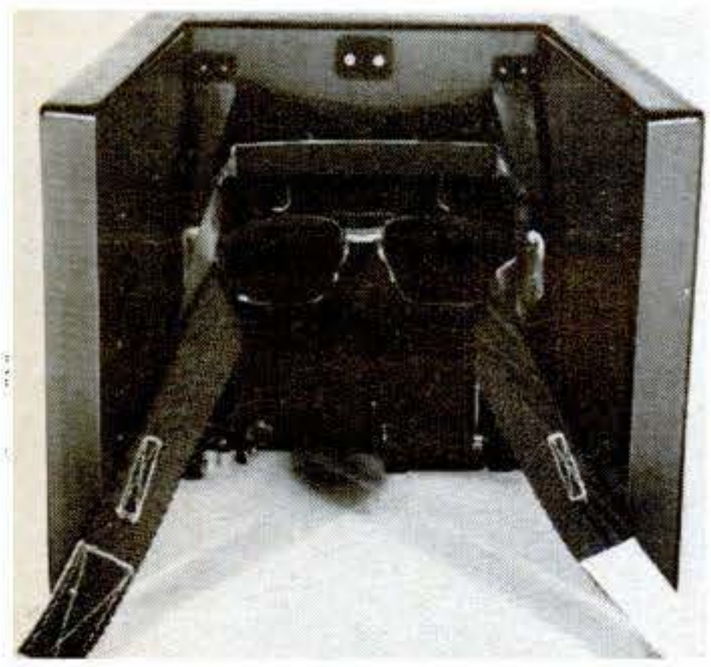
This is a photo made by electronic flash—five million candlepower-seconds worth. The huge strobe lamp was aimed at MIT from the roof of a Boston apartment house across the Charles River. The picture, taken from atop a 52-story building, was made under the supervision of strobe-light pioneer Harold E. Edgerton, of MIT.

Flashes aboard Apollo 16

Forty-nine hours and 10 minutes after lift-off, 160,000 miles from Earth, the Apollo 16 astronauts began a little-reported experiment—ALFMED. The acronym belongs to the peculiar apparatus pictured here from without and within; it stands for Apollo Light Flash Moving Emulsion Detector. Its purpose: to settle the origin of those mysterious flashes of light that have been seen by crewmen of every Apollo mission since Apollo 11.

The flashes have been particularly





unnerving because they are seen inside the eyes, behind closed eyelids, usually during a rest period while the command module is darkened. They take the form of dots and streaks, and average one to two per minute.

Several theories have been advanced to account for the flashes, including one that holds cosmic rays to be responsible. The ALFMED apparatus is designed to record passage of particles bombarding an astronaut's head, using special photographic plates developed by Eastman Kodak. One set of plates is fixed relative to the astronaut's head; an adjacent set is moved vertically by a built-in motor at a constant rate.

The scheme gives scientists a means of calculating the trajectories of incident radiation. When the astronaut reports aloud on what he sees, a tape of his voice can be timed against the known motion of the photographic plate, thus providing correlation between cosmic-ray "strikes" and the visual flashes.

On Apollo 16, astronaut Charles Duke reported some 50 flashes (by saying "mark"), an average of about one a minute, and just what the scientists involved were hoping for. Next step: analysis of the plates by computer.

New evidence for antimatter

Results from a recent Russian balloon-borne experiment support the intriguing theory that the universe is composed of two basic kinds of material, *matter* and *antimatter*.

Scientists at the Ioffe Physical-Technical Institute in Leningrad sent detectors aloft for 20 hours 20 miles above the Earth. When the instruments (including four spark chambers) were recovered, they revealed traces of seven *antiprotons*—the antiparticles of protons. Such particles can originate when cosmic rays bombard the atmosphere; to reduce this possibility, the Russians sent their experiment 20 miles up.

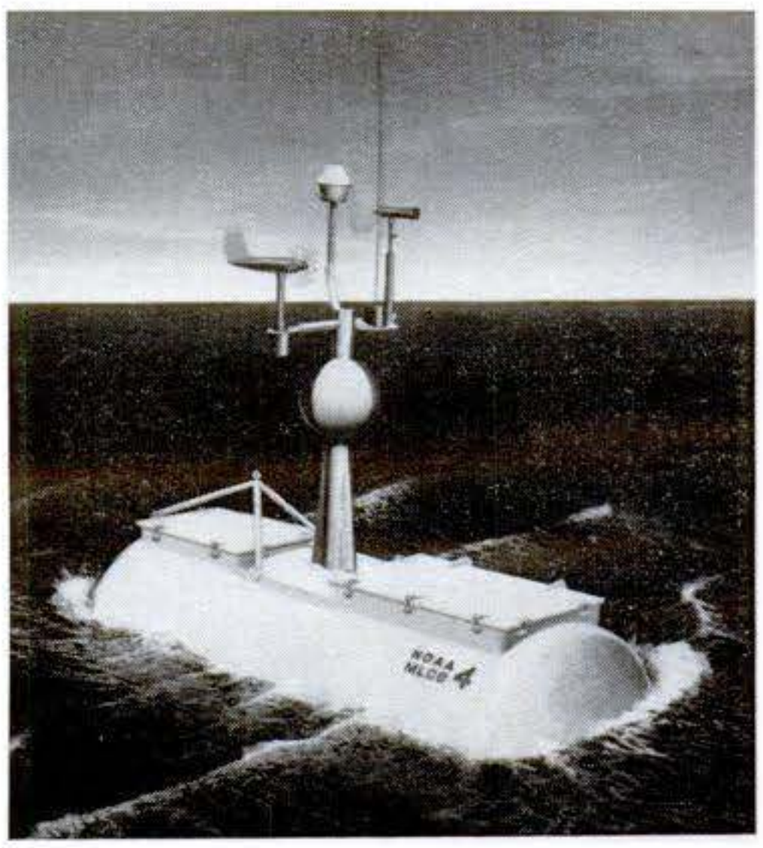
Cleaning up blood

A revolution in medicine may be underway with the development in Sweden of a remarkable apparatus for removing poisons or other unwanted substances from a patient's blood.

Invented by Prof. Holger Hydén of Gothenburg U., with a design assist from Dr. Victor Hasselblad of camera fame, the device is about the size of a pocket transistor radio. It consists of 10 or more plates, about 0.7mm apart. The plates are coated with the "cleanup" agent—enzymes or antibodies, for example—to be used in treating the specific condition. The device is strapped to the patient's lower arm, and plastic tubes are connected between it and a vein and artery, with the blood flowing through the unit under its own pressure.

The treatment has the advantage that blood-treating substances do not enter the body, thus avoiding harmful side effects. Still in the prototype stage, the technique may succeed in ridding blood of such poisons as lead, mercury, and barbiturates; help overcome the body's rejection of transplanted organs; and even treat some forms of blood cancers.

Experimental weather watcher



Three of the strange-looking craft you see here will be built by Lockheed Missiles & Space Co. for the National Oceanic and Atmospheric Administration (NOAA). They are weather-data buoys, and if sea trials in the Gulf of Mexico early next year prove successful, their descendants will form part of worldwide buoy networks that will constantly monitor the ocean-air interface and relay the information to a central station via satellite.

Continued

Copyrighted material

New from Maverick: unexpected luxury in a compact car.

Introducing Ford Maverick's Luxury Decor Option: glove-soft reclining bucket seats. Plush cut pile carpeting. European type arm rests. Wood grained dash. Outside: vinyl grained roof, color-coordinated body moulding and bumper guards, color-keyed wheel covers, radial-ply white sidewall tires. All this in the reliable 2-door and 4-door Maverick, at a surprisingly low price.

See your Ford Dealer.

FORD MAVERICK

FORD DIVISION

Interior shown with radio and automatic transmission, optional at extra cost.

The buoy is an 11-foot-long horizontal steel cylinder with a four-foot keel at one end to provide stability in high winds and rough water. It will be moored in water as deep as 24,000 feet, and will measure air temperature and pressure, wind speed and direction, water pressure 200 meters down, and water temperature at depths between two and 200 meters.

Tenth planet found?

One sure path to astronomical immortality has been to discover a planet. After all, there are only nine of them orbiting the sun. Or are there? Since the discovery of the ninth planet, Pluto, 42 years ago, some astronomers have insistently postulated the existence of an even more remote tenth planet—Planet X. Now Joseph L. Brady, a scientist at the Lawrence Livermore Laboratory of the U. of California, says that he may have found Planet X—not visually or photographically, but by inference and computer analysis.

How? Brady examined the course of Halley's Comet, a periodic visitor to the solar system whose behavior is marked by peculiar irregularities. They seemed to be accounted for by the presence of a distant planet's gravitational pull.

Computer analysis showed Brady that the eccentric behavior of Halley's Comet could indeed be explained by a Planet X—but only by one with its own peculiar profile. It would have to be almost six billion miles from the sun, three times bigger than Saturn, and with a retrograde motion. Confirmation of Brady's theory will come when—and if—someone photographs Planet X.

A tooth-shaking event

This looks like a fiendish torture device, but it isn't. It's a tooth-shaking machine, and Dr. David H. Noyes (left), an assistant professor of physiology at Ohio State U., is attaching it to the teeth of technical assistant Wilbur Reed, who should probably go down in history alongside the yellow-fever volunteers. In use, a cylinder cemented to a tooth vibrates at various frequencies. The machine measures the force (not more than a tenth of an ounce) and the tooth's response (average movement is about one ten-thousandth of an inch). The subject can listen to music over headphones to overcome acute anxiety.

Actually, the process is painless, and the purpose noble: to develop means of detecting the onset of bone and gum disease—periodontal disease—before permanent damage occurs. The disease is the largest cause of tooth loss for people over 30 years old. The mobility of a tooth may be an important index of the condition of its supporting structures.

Flood-warning system

One hundred fifty-three people drowned in flash floods when a last-gasping Hurricane Camille unloaded 27 inches of rain in eight hours on the James River Basin of Virginia, in August 1969. To prevent the recurrence of another such catastrophe, the National Weather Service is activating the first of a new series of warning systems that will automatically set off an alarm when a flash flood threatens. Installed near Wheeling, W. Va., the system consists of a robot water-level sensor (incorporating a toilet-tank-type float device) at an upstream point on the river, an electric power supply several miles or more downstream, and an alarm that will flash, buzz, or otherwise signal a town in danger. PS

Get big-pay power with NTS Home Training!

Train now for a rewarding technical career — with real opportunity, security, and high pay! NTS gives you a wide range of fields: Color TV Servicing, Auto Mechanics, Air Conditioning, Home Appliance Repair, and many more! You learn on the actual tools and equipment of the trade — yours to keep at no extra cost! It's fast, easy, exciting . . . and it really pays off!
Get moving today! Mail coupon, receive NTS color catalog FREE! No obligation, no salesman will call.

ELECTRONICS DIVISION
- Master Course in Color TV Servicing
- Master Course in B & W TV & Radio Servicing
- Master Course in Electronic Communications
- FCC License Course
- Master Course in Electronics Technology
- Industrial and Automation Electronics
- Computer Electronics

- Audio Electronics Servicing
- Basic Electronics

Up to 32 kits . . . Build your own color TV — Compu-Trainer — oscilloscope — many others. See catalog for details.

MECHANICS DIVISION
- Master Course in Auto, Truck, & Diesel Mechanics
- Automotive Mechanics
- Truck & Heavy Duty Mechanics
- Engine Tune-Up & Electricity

8-unit electronic diagnostic kit, 109-pc. tool kit. See catalog for details.

HOME APPLIANCE DIVISION
- Home Appliance Master Technician's Course
- Home Appliances Servicing
- Handyman Appliance Repair

Up to 8 kits including new exclusive Circuit Trainer. See catalog for details.

AIR CONDITIONING, REFRIGERATION & HEATING DIVISION

- Master Course in Air Conditioning, Refrigeration & Heating
- Air Conditioning & Heating
- Refrigeration

16 kits. Leak detector, Hermetic analyzer, tools & others. See catalog for details.

APPROVED FOR VETERANS
ACCREDITED MEMBER: National Home Study Council, National Association of Trade & Technical Schools.

Send for FREE illustrated catalog and complete information on the field you choose. Sample lesson included.

CLASSROOM TRAINING AT LOS ANGELES
NTS occupies a city block with over a million dollars in training facilities. Check special box for details.

NATIONAL TECHNICAL SCHOOLS
Worldwide Training Since 1905
4000 So. Figueroa St., Los Angeles, Calif. 90037

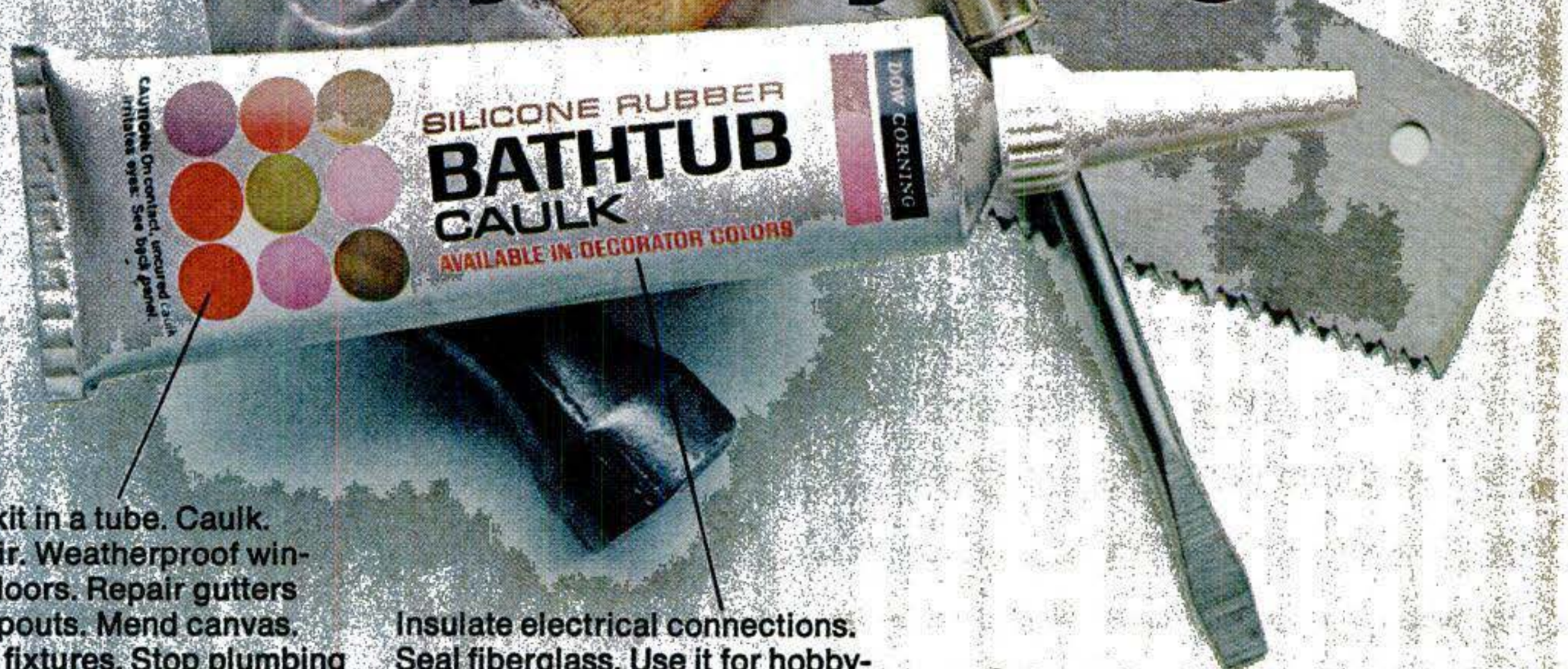
NATIONAL TECHNICAL SCHOOLS
Worldwide Training Since 1905
4000 So. Figueroa St., Los Angeles, Cal. 90037

Please rush FREE catalog and sample lesson for division checked below. Check one only.
☐ ELECTRONICS DIVISION (Dept. 202-072
☐ AIR CONDITIONING, REFRIGERATION & HEATING DIVISION
☐ MECHANICS DIVISION
☐ HOME APPLIANCE DIVISION

Name _____ Age _____
Address _____
City _____ State _____ Zip _____
☐ Check for veteran training under new G.I. Bill.
☐ Check if interested ONLY in classroom training at Los Angeles.

Copyrighted material

Everything you need to fix practically everything.



It's a fix-it kit in a tube. Caulk. Seal. Repair. Weatherproof windows and doors. Repair gutters and downspouts. Mend canvas. Mount wall fixtures. Stop plumbing leaks. Seal ducts and vents. Use *Dow Corning* Silicone Bathtub Caulk and Sealers for just about anything. Make or repair gaskets.

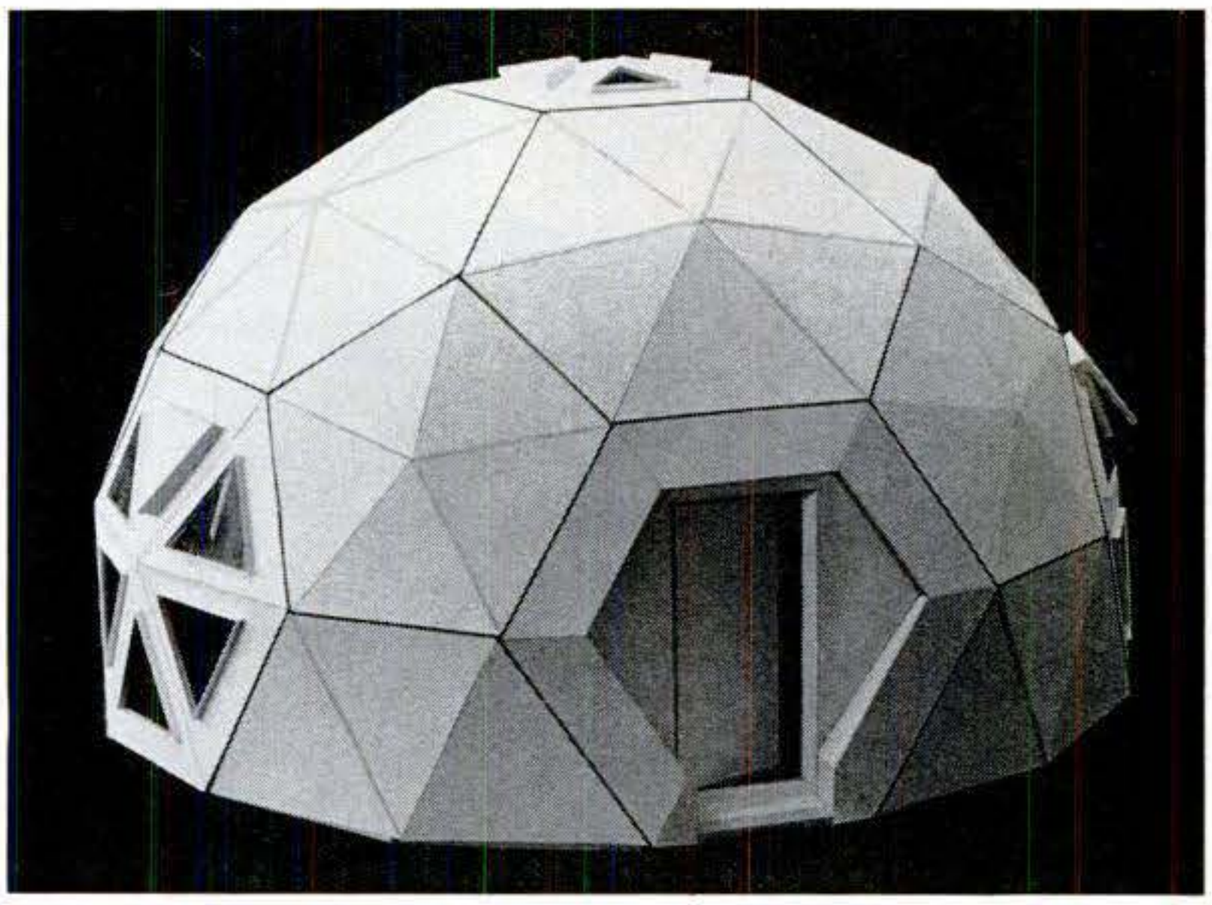
Insulate electrical connections. Seal fiberglass. Use it for hobby-craft applications, or in the garage. Buy the Caulk in white or decorator colors. Buy Silicone Sealers in clear, black and aluminum. Look for other quality Dow Corning home maintenance products in your favorite hardware department.

Get your free idea booklet, today. Write Dow Corning Corp., Dept. D-2102, Midland, Michigan 48640.

DOW CORNING

DOW CORNING

Build a Dome Home? Now You Can!



Buy construction plans for Bucky Fuller's new Hexa-Pent Dome—and go right to work. Famous inventor of the geodesic dome developed the plans especially for do-it-yourselfers. Cut and shape the two-by-four framing pieces with a table saw, radial-arm saw, and jointer—or have a local woodworking shop make the cuts—and then assemble the parts into hexagon and pentagon building units for a dome shell. (CAUTION: Hand tools are not sufficient for this project.)

Along with detailed building plans you get an engineering load study made on the prototype dome. This should help you get a building permit if one is needed. Materials for the original 24-foot diameter dome cost about $1000—for the finished waterproof *shell*, without insulation, interior wall surfacing, flooring, utility lines, or interior partitions. For these details, make your own choices from conventional home-building practices. A five-eights dome of 24-foot diameter stands about 14 feet at the center. Therefore, you can have at least a partial second floor. For other details, see Popular Science for May and June 1972.

Mail your remittance along with the coupon. Allow three weeks for delivery.

Popular Science Plans Div. (July 72)
355 Lexington Avenue, New York, N. Y. 10017

Enclosed is my check or money order for $15. Please send me one set of Bucky Fuller's Hexa-Pent Dome plans (No. 5544).

NOTE: One set of plans entitles you to build ONE DOME ONLY.

Name_____

Street_____

City_____

State_____ Zip_____

Copyrighted material

In a TV interview, Norbye (right) discusses the Mazda rotary engine with Christopher Jones on Channel 5 in New York.

The View Down the Road

...news and comment on cars and driving

By **JAN P. NORBYE** / *PS Automotive Editor*

Mazda rotary engine will meet the 1975 emission standards!

What is happening? Can those "impossible" standards be met? Let's take a cool look at the facts.

First, you probably know that Ford, General Motors, Chrysler, International Harvester, and Volvo have asked the Environmental Protection Agency (EPA) for a one-year extension because of inability to meet the limits on time. It is implicit that they think they *can* meet them for '76. How? Probably by adding "everything but the kitchen sink"—thermal reactor, exhaust-gas recirculation, catalytic converter.

Now, in testimony at the EPA hearings in Washington, Dr. Takushi Mitsunari of Mazda has stated, "We have a fairly bright outlook as to the feasibility of meeting the 1975 requirements" with the Wankel engine, using a thermal reactor but not—repeat *not*—a catalyst. He made it clear that the Mazda piston engines do not qualify.

How clean is the Mazda rotary?

Three Mazda cars went through the '75 federal test procedures with these results (in grams per mile):

	HC	CO	NO_x
'75 standards	0.46	4.7	3.0
Mazda average	0.17	2.2	0.93

Dr. Mitsunari expressed confidence that these figures have the margin to allow for prototype-to-production slippage and the 50,000-mile deterioration factor based on experience with the 1970-72 model twin-rotor production engine with a thermal reactor. How clean the Mazda rotary is won't sink in until you look at what has been achieved with U.S. experimental power units, such as the stratified-charge fuel-injection Ford Proco (with and without catalyst) and Williams Research gas turbine:

	HC	CO	NO_x
Proco (w. cat.)	0.15	4.3	0.51
Proco (w/o cat.)	1.49	13.2	0.67
Williams turbine	0.34	4.5	2.15

What makes the rotary so clean?

It can't be just the thermal reactor, can it? The Mazda has higher exhaust-gas temperatures than piston engines, so the reactor does work at far higher efficiency. Then the rotary is low in NO_x emissions because of lower burning rate and lower peak combustion temperatures.

What next? Mazda will confirm '75-model durability, climate adaptability, and general drivability by April 1973. Preparation for production will begin in December '73. After pilot production starts in the spring of '74, full production will begin in August '74. Now the EPA must decide whether Mazda will be *the only legal car* in '75.

Copyrighted material

Where does the EPA stand?

William D. Ruckelshaus, EPA administrator, has said that no delay would be granted to any company as long as one firm *did* meet the '75 standards. The Mazda testimony indicates one decision: no extension.

The implication is that since a "clean enough" engine exists, it will have to be adopted 100 percent by all makers. Of course, GM will have its rotary engine in production in '74 but total conversion may not be achieved until '77. Ford, Chrysler, and others are far behind. Even if they decide today to switch completely to rotary engines, they could not be in production by '75 start-up.

That automatically dictates an extension. Even if the reason is to give auto makers time to develop rotary engines and tool up for them, they could also use the time to work on piston engines. So they will face the choice of going all out for the rotary, going all out for a modified piston engine, or funding *two* programs.

I think the first course of action is the only one acceptable. There's proof (in the Mazda testimony) that the rotary can be cleaned up at lower cost—a fact confirmed by spokesmen for Curtiss-Wright. A decision by any auto maker to stick to the piston engine would automatically be a commitment to use catalytic converters (which will add $50 to $200 to the cost, steal some power from the engine, and have dubious durability).

Cost is quite separate from the rotary's other advantages—lighter weight, smaller bulk, smoother running, lower octane requirement, lower production cost. Naturally it will take huge investments to get it into production, while existing plants may be idled. But this is just another challenge to the auto industry.

New hope for the diesel?

If the Wankel sweeps the passenger-car field, the diesel could be the only piston engine still legal for cars. Diesel emission standards for '75 have not been set, but Mercedes-Benz has said they expect to meet them, whatever they may turn out to be.

Diesel-vehicle tests on a grams-per-mile basis have not yet been conducted, and standards won't be set until the state of the art is known and quantified. However, we do know what diesels emit and in what proportions. The diesel engine emits only 50 to 65 percent of the hydrocarbons that escape from a '71 gasoline-powered car. And carbon monoxide emissions are negligible: 1.65 to 3.3 percent of gasoline-engine levels. The oxides-of-nitrogen emissions have not been completely mapped, but we know they are lower —42 to 75 percent of gasoline-engine levels.

Assuming the diesel can meet future standards, can it compete with the Wankel in dollars per horsepower? And does it have other drawbacks compared with the Wankel? Diesels cost more to build than piston-type gasoline engines, and are also much heavier. But the diesel has excellent fuel economy, particularly in the part-load range.

If you ever get close to diesel trucks, you'll ask about odor and noise. I have driven the latest diesel cars from Mercedes-Benz and Peugeot, and the odor problem just doesn't exist any more. What about noise? Diesel engines make four kinds of noise. First, the roar of fresh air entering the engine—minimized by improved filter design. Next, exhaust noise—licked by improved mufflers. Perhaps loudest is "diesel knock," from the extremely rapid pressure rise in the cylinders, due to compression ratios of 21:1 (Mercedes) to 22.3:1 (Peugeot). Cylinder heads with swirl chambers have minimized this, so knock won't bother you, except at idle.

Finally, there's noise from the engine structure itself due to vibration. Development work on reinforcement of the cylinders and outer walls of the engine is well under way, and sound-deadening materials in the crankcase and cylinder block to dampen vibrations are coming into use. I believe a clean, quiet diesel is possible, but at what cost? PS

After a hard week's work, you need a pickup.

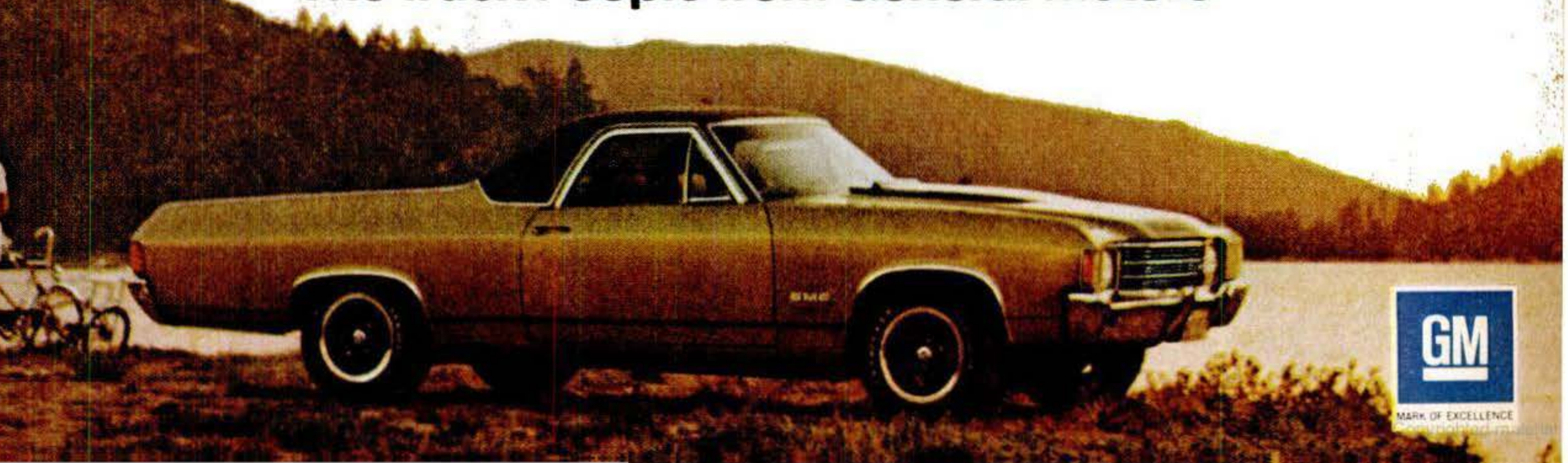
Our kind of pickup.
A GMC that's worked as hard as you have since early Monday morning. And now's as ready as you are for fun. Born from the very beginning to lead two lives. Eager to load up with a half ton of gear or a dozen feet of camper body and be off.

A car's kind of comfort.
A lot of vehicles wish they could look as good inside as the GMC Sierra Grande on the left or our sleek Sprint below. Bucket seats, shift console, thick carpeting, air conditioning, all available.

A truck's kind of strength.
Truck muscles ripple beneath every GMC for smooth trailer towing. Components have been proved through years of back-breaking jobs. V8 power is available to 400-cu.-in. Talk to your GMC dealer. It can be a lot of fun.

GMC

The Truck People from General Motors



Look and Listen

News, comment, and opinion from the world of home-entertainment electronics

By C. P. GILMORE

For the man who has everything

You're watching TV and an address flashes on the screen. You don't have a pencil, so you reach over and push a button. Instantly, a second screen lights up and freezes the view while the primary screen continues to show the regular TV program.

If this scene appeals to you, you'll soon be able to live it. Hitachi showed the two-screen set recently; it'll be on the U.S. market sometime later this year.

The secret is a four-inch magnetic disk spinning at 3,600 rpm. When you push the button, the disk records a single frame, displays it on the freeze screen until you push the button again.

Hitachi says people will want to use the freeze-frame feature to get closer glimpses of TV stars, stop sports at critical points, and trap images of complicated scoreboards. You'd have to want to do these things pretty badly; the complete rig with 13- and 9-inch black-and-white screens will go for about $500.

Movie cassettes for rent

Private showings of first-run Hollywood movies in your home? It's about to happen. Now Columbia Pictures and Cartrivision have announced the formation of a new company called Cartridge Rental Network. It will distribute video material you'll be able to rent. First out of the bag: some 200 movies and special programs such as "Bridge over the River Kwai," "High Noon," "The Anderson Tapes," and "World Series Highlights." The cartridges can't be rewound with home equipment, so you'll get only one play; cost per showing will run from $3 to $6.

The company plans to set up 51 distributorships shortly, should have cartridges available in the Chicago area (where Sears is starting to sell playback units) by the time you read this.

Confusion, confusion

As Cartrivision goes happily ahead with its plans, the machinery picture gets even more mixed up, if that's possible.

Several years ago, the Electronics Industries Association of Japan set up video-tape standards built around half-inch tape, and most Japanese electronics companies said they would observe the standards. But Sony didn't, and now has its U-Matic three-quarter-inch tape system on the market. (Teac also announced that it has set up a new company in cooperation with Sony to produce video cassettes using ¾-inch tape.)

Now Panasonic says it will start marketing a series of cassette player/record-

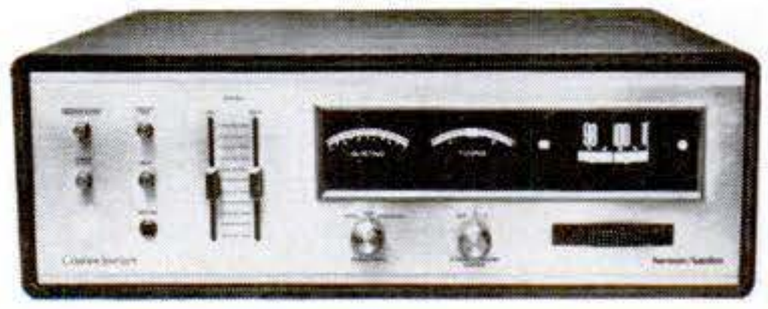
ers based on the ½-inch EIAJ standard that everybody agreed on but nobody has done much about until now. The line will include a playback-only unit ($950), and a record/playback machine ($1,300) and record/playback tuner device (photo, $1,450).

The units are compatible with the half-inch reel-to-reel machines now on the market; tape recorded on r-to-r machines can be rewound directly into the cassette. The cassette is smaller than other entries—the size of an audio cartridge rather than a hefty novel.

Finally, Panasonic (like Sony) will be aiming for the educational and institutional market, unlike Cartrivision and RCA, who will sell primarily to individuals for in-home use. All clear?

Down with noise!

More and more stations are broadcasting Dolbyized signals these days to cut down on noise and improve effective range [L & L, Aug. '71]. Until recently,



anyone wanting to take full advantage of these quieter broadcasts had to have a separate Dolby unit.

Now Harman Kardon has introduced a new FM tuner with built-in Dolby circuits. The Citation 14 will include many other technological refinements as well and will sell for $525.

Equipment and record reviews by Ken Furie

Interested in good sound? Then there's something new to grapple with: four-channel headphones. I've spent some time trying out two versions: Koss's 2+2 ($85) and Superex' QT-4 ($50).

I've found that for ambience-type four-channel (where only *reflected* sound comes from the rear), four-channel phones have little value. But when there's *direct* sound coming from both front and rear, there's no way two-channel phones can reproduce it.

So if this is the kind of listening you're interested in, four-channel phones may be a good investment. Let me add one warning: If you're listening to a recording that does have pronounced separation, sounds that jump around will produce quick, extreme changes in pressure on your ears—which can be painful.

Which set for you? The Koss phones are audibly better, but cost $35 more. Both give ample value for their prices.

* * *

An experience this month drove home how big a part the sound can play in my reaction to a recorded performance. The cartridge of Placido Domingo's latest RCA recital, *Domingo Sings Caruso* (arg!), sounded like one of the best cartridges I've heard. So I chalked up my lukewarm response to the performances. Some time later, the disc arrived—and I couldn't believe it was the same recording. The cartridge didn't have much obvious distortion (except breakup in loud passages), but it clearly wasn't reproducing the mids and highs—sabotaging these first-rate performances of very familiar and very unfamiliar Italian and French tenor arias.

Cartridges don't *have* to sound so bad, but makers seem to feel there's no point trying for anything except volume (and never mind tape saturation). But even

Copyrighted material

when a cartridge sounds okay, there's another familiar gripe. Would you believe that, of the three track switches in the *Cabaret* film soundtrack (ABC/RCA), two interrupt songs? The cassette version, of course, has no such problem—and I recommend it highly.

Last April I reported excitedly on the first three volumes of Antal Dorati's recording with the Philharmonia Hungarica of the complete Haydn symphonies. Now, Volume Four, containing *Symphonies 73-81* (London Stereo Treasury, four discs, $12), is out. Performances, sound, and packaging are just as exceptional; the price remains incredibly low.

Reviews by Arthur Fisher

A recent assortment of goodies:

Opera Ballets. Herbert von Karajan conducting the Berlin Philharmonic (DGG). This kind of music tends to get dismissed as "light classical"—Ponchielli's Dance of the Hours from *La Gioconda*, Borodin's Polovtsian Dances from *Prince Igor*, and so on. By refusing to toss them off lightly, von Karajan invests these war-horses with a vitality I haven't heard for years. Incidentally, the cassette version (non-Dolby) of this release, when played on a high-quality deck (I used a Teac 350), comes surprisingly close to the excellent sound of the disc and is well worth considering.

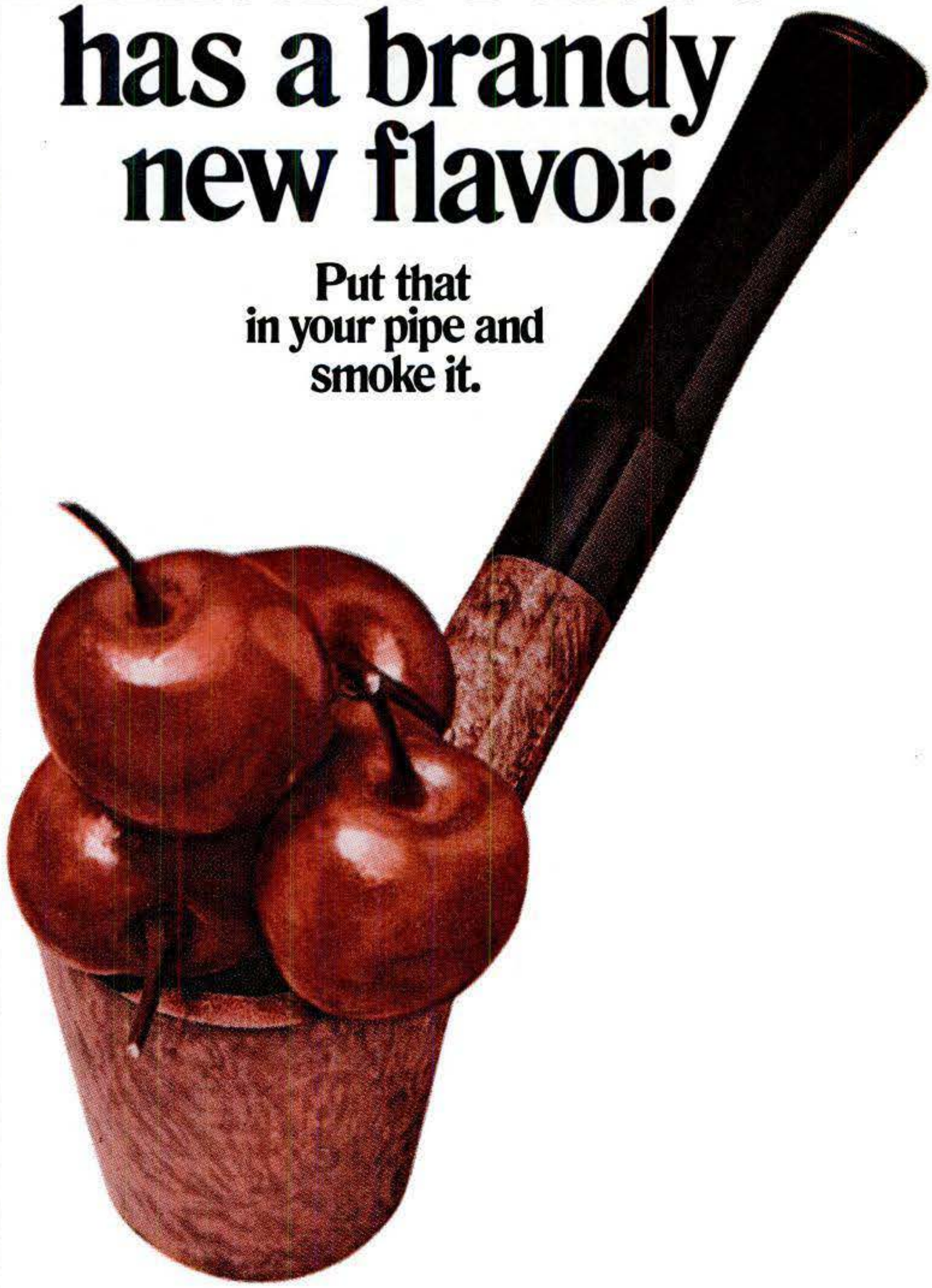
The Varèse Album (Columbia, two discs, $7). Robert Craft conducting the Columbia Symphony Orchestra. A stunning collection of works spanning the years 1922-1958 by Edgard Varèse, the Paris-born pioneer of modern music. He once wrote: "I do not write experimental music. My experimenting is done before I make the music. Afterwards, it is the listener who must experiment." Many of the selections are rich in exotic percussion (one piece calls for a battery of 37 percussion instruments) and will test your equipment's transient response unmercifully, and perhaps your neighbors' patience, too. If you don't know Varèse, and have open ears and mind, run—don't walk—to get this album.

A Tribute to Woody Guthrie, Part One (Columbia). A labor of love, and sounds it. Woodrow Wilson Guthrie celebrated the American land and people in more than a thousand folk songs before his death in 1967. Two concerts were held in tribute to his work, in 1968 and 1970, and this album is the first installment from the tapes made then. No folk writer could hope for a better set of balladeers than Guthrie gets here: Pete Seeger, Odetta, Judy Collins, Tom Paxton, Bob Dylan, Richie Havens, and his own son, Arlo Guthrie. The songs include *This Train's Bound for Glory; So Long, It's Been Good to Know Yuh . . .* The sound is sometimes only passable, but it can't detract from this glowing evocation of a great American artist.

Dvorak's *Piano Quintet in A, Op. 81.* Artur Rubinstein and the Guarneri Quartet (RCA). This endearingly romantic work is well served by the Guarneri and that noblest romantic of them all, Artur Rubinstein. The sound is warm and resonant, well suited to the rather lush material. A very nice recording indeed. PS

Mixture No. 79 has a brandy new flavor.

Put that in your pipe and smoke it.



Pour yourself a pipeful of cherry brandy.

Cherry Brandy Flavor Mixture No. 79. The new tobacco with the flavor and fragrance of plump, juicy cherries. And the richness of fine old after-dinner brandy.

Cherry Brandy Flavor Mixture No. 79. More and more men will be picking it.

Cherry Brandy Flavor Mixture No. 79. Another great men's fragrance.

Sutliff Tobacco Co., Richmond, Va. 23224

Copyrighted material

CHRYSLER MOTORS CORPORATION

We build three different wagons exactly the same way. With plenty of room.

Plymouth Satellite Regent

Plymouth Sport Suburban

Chrysler Town & Country

You see, we know everyone buys a wagon for the same basic reason. Room.

That's why every one of these wagons has room enough for 4′ x 8′ plywood sheets laid flat, with the tailgate closed.

And it's easy to use that huge cargo space because every one of these wagons comes with a 3-way tailgate. It opens down for things. Out for people. It even opens out with the glass up.

All these wagons offer 3-seat models, too. In case you want to use that extra room for people instead of cargo.

And these wagons all offer an integrated air deflector to help keep dust off the rear window.

Then, if our wagons are so much alike, why do we build three different wagons?

Well, while everyone has the same needs in a wagon, not everyone has the same wants in a wagon.

So we build a Satellite wagon. A Fury wagon. And a Chrysler wagon.

Our mid-size Satellite wagon gives you plenty of room for knees and elbows. And a very comfortable interior.

If you want even more elbow room, look into our full-size Fury. Fury also has a power-operated tailgate window, standard. Satellite's is optional.

The Chrysler Town & Country is very simply one of the most luxurious wagons you can buy. It comes with simulated wood-grain appliqué on the body sides. Deep loop-pile carpeting covers not only the floor, but the cargo area as well. There's a plush all-vinyl bench seat with a fold-down center armrest. And a big 400 cubic inch V-8.

But whatever Chrysler-Plymouth wagon you get, you can be sure you're getting all the utility you need in a wagon.

CHRYSLER

Plymouth

Coming through with the kind of car America wants.

Popular Science
REG. U.S. PAT. OFF. MONTHLY

PS: What's News...

Keeping You Posted from Behind the Scenes

This month's cover illustration is another example of how the best-laid plans often go awry. The idea for the cover started on Art Editor Dave Houser's sketch pad. He and Automotive Editor Jan Norbye convinced me it could be done just as Dave had sketched it, by using a 70mm, high-speed sequence camera. They hopped a plane to Detroit and all went well on the first day of photography out at the proving grounds—or so they thought. When the film was developed, it was blank. Something had happened to the camera shutter. And there was no more 70mm color film to be found in Detroit.

Our editors and the GM team of photographers and drivers didn't let this defeat them, though. They skidded the car through the marked course dozens of times, snapping a photo with a still camera as the car reached a different part of the course on each run. Jan and Dave came back with a perfectly matched sequence and our photo-lab boys did the rest by putting them all together.

Wedding of the rotaries

I can't imagine a more inevitable match than the mating of the Donbar rotary heat exchanger [PS, Mar. '71] and the Wankel rotary engine. Wankel G.m.b.H. recently announced an agreement with Donbar Development Corp. for the construction of prototype rotary radiators for the Wankel engine.

If you remember our original article on the rotary heat exchanger, you know it has several unique advantages. The cooling liquid flows through hollow blades arranged something like those in a centrifugal blower. Air drawn over the blades by the spinning action cools the liquid with remarkable efficiency. As a rotary radiator, the device would replace the present radiator and fan. It should be more compact and permit much greater flexibility in mounting than conventional systems.

Flying bargain

Actual flight tests of the NASA Supercritical Wing ["NASA's New Mach 1 Airliner," PS, Apr. '72] have now demonstrated in practice the theoretical promise of the new airfoil shape.

A modified F-8 jet fighter fitted with the new wings was used for the flight tests. Results confirm the wind-tunnel predictions that aerodynamic drag near Mach 1 (speed of sound) is significantly reduced from that experienced by a conventional wing shape. This means that the aircraft can fly faster without using more power.

Happy ending for a trip

Contrary to what some cynics think, manufacturers don't always get mad at us when we report shortcomings that turn up in our tests of their products. Often they thank us and go back to the drawing board to eliminate the problem. Case in point: In our February cover story on the Sea Knife, Boating Editor Jim Roe told of a side-slip-and-trip problem that he found during one of his test maneuvers. Admittedly, you had to be looking for trouble to get the boat to show up this one bad habit—but looking for trouble is part of our editor's job. Jim was told it had never happened in all previous testing. Later Jim received a letter from Peter Payne, president of Blade Hulls, Inc., outlining the changes they had made in the hull to correct this problem. The last paragraph in the letter read: "I need hardly say how indebted we feel to you for finding this phenomenon and for your analysis of its cause."

Case of the missing monoxide

We all know carbon monoxide is a killer. From our cars and industrial plants we pour more than 200 million tons of this colorless, odorless, tasteless lethal gas into our atmosphere yearly. At this rate, scientists calculate that CO levels should have doubled in the past four or five years. The mystery bugging scientific sleuths is that it *didn't*—carbon monoxide in the atmosphere has remained practically constant for the last 10 to 20 years. In a switch on the classic Sherlock Holmes story line, scientists at the Stanford Research Institute have uncovered evidence pointing to the good guys: Fungi, tiny microorganisms living in the soil, have been eating the missing monoxide. When SRI scientists introduced CO into sealed chambers containing air and unsterile soil, CO levels dropped from 120 parts per million to zero in three hours. When they performed a similar test using sterile soil, CO levels remained static. They deduced that the CO-reducing activity must be part of the life style of microorganisms living in the soil. They isolated more than 200 cultures of bacteria and fungi, and of the 200 they found 16 capable of removing CO. All 16 were common fungi such as are found in your lawn and garden.

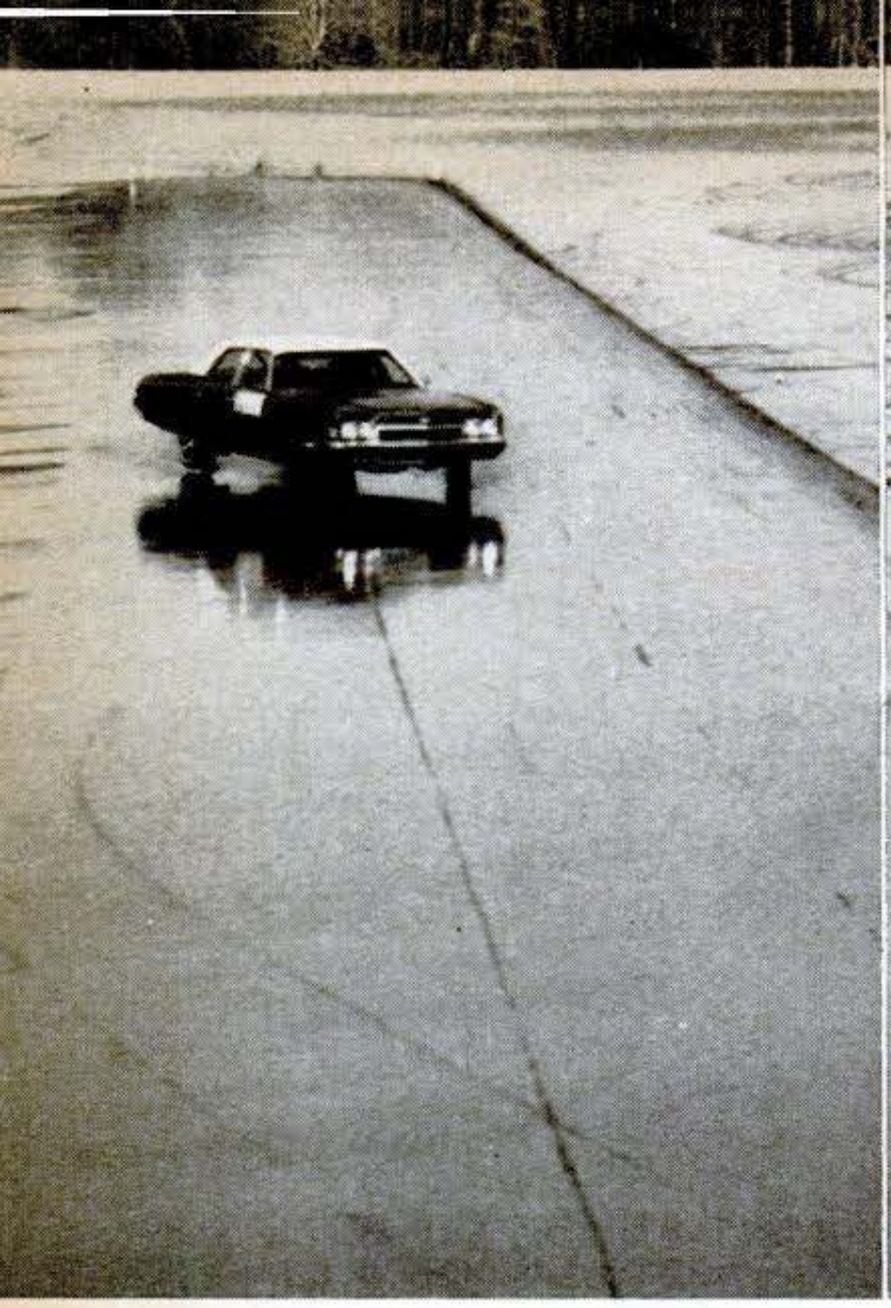
New theory for cause of continental drift

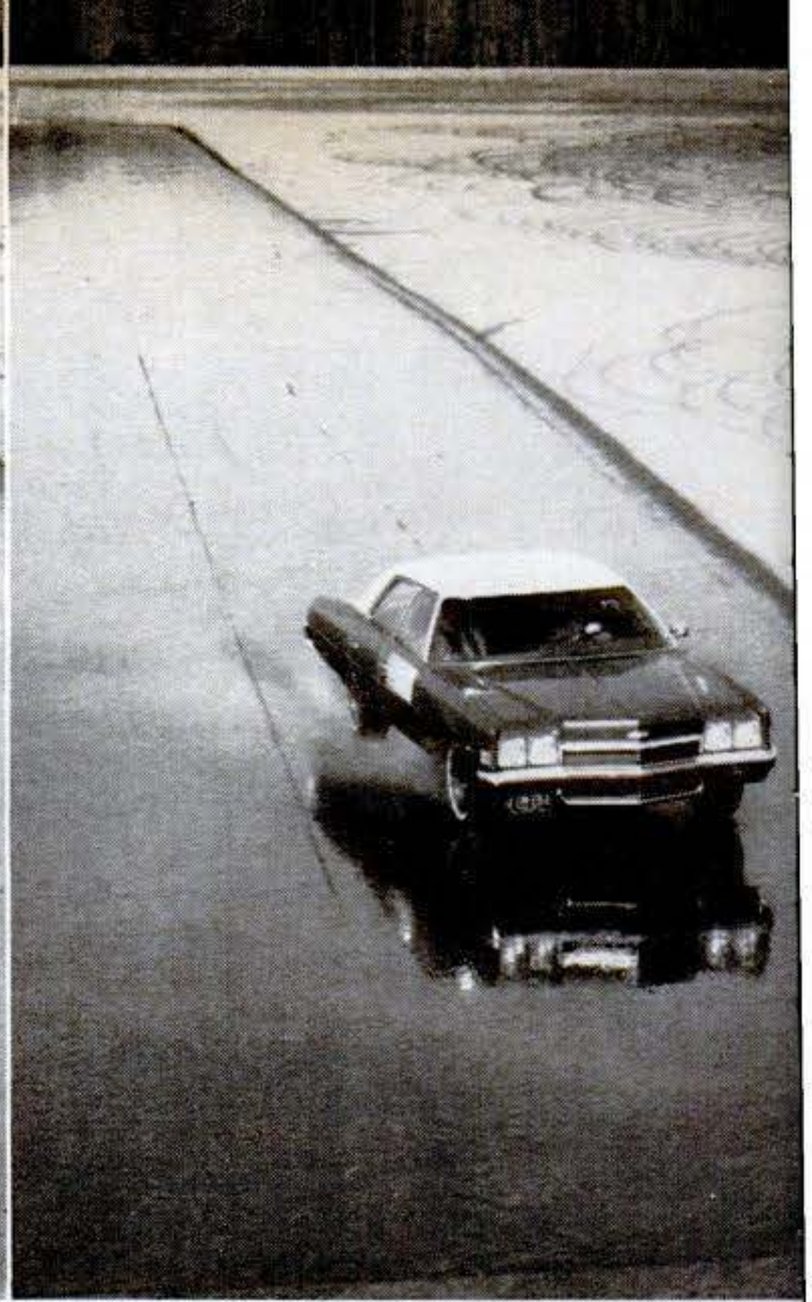
Shortly after we sent our article on plate tectonics [PS, June '72] to the printer, we received information from the Dept. of the Interior that Dr. Martin F. Kane, a geophysicist with the U.S. Geological Survey, has offered a new theory to explain the cause of continental drift. While noting that the theory of continental drift has been substantially confirmed in recent years, Dr. Kane said, "A fully acceptable explanation for the cause of drift has not been cited." To explain his theory, Kane relies on two well-established facts: the long-term change in the position of the Earth's rotational pole, and the Coriolis effect. The Coriolis force, named after the French scientist of the last century who first discussed it, causes the apparent deflection, due to the Earth's rotation, of the path of any moving object with a component of motion toward the Earth's pole. Deflection is easterly north of the equator and to the west in the southern hemisphere. Polar "wandering" could cause the part of a continental plate north of the equator to tend to move east and the part south of the equator west. Resulting stresses, Kane suggests, could cause separation of the plates along existing lines of weakness. Comparing the "wandering" of the North Pole over the past 230 million years with patterns of continental drift shows reasonably good agreement between his model and what actually happened, Kane said.

Hubert P. Luckett

Editor-in-Chief

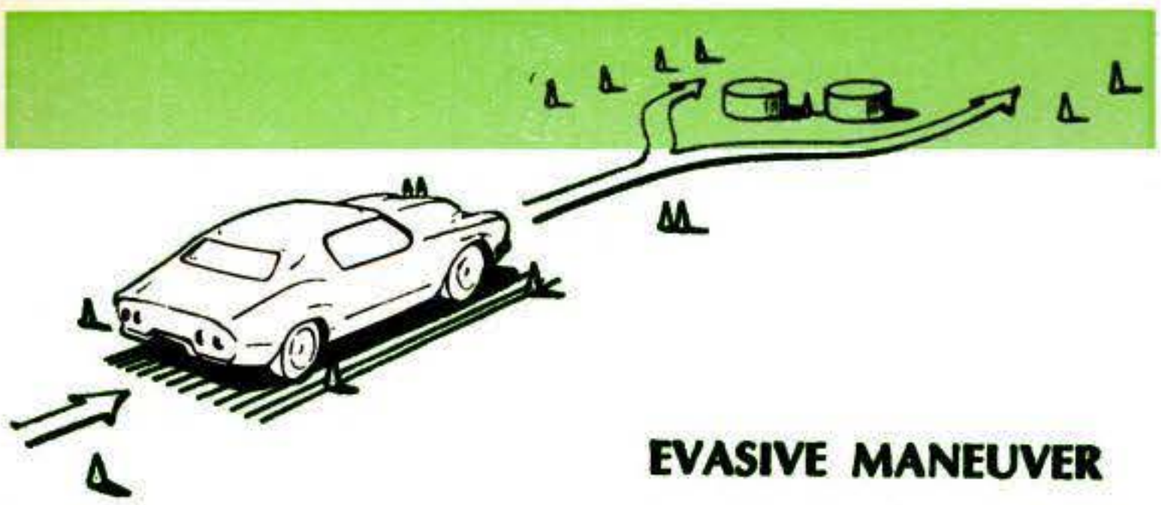
Copyrighted material





GM'S ADVANCED DRIVING COURSE:

How to Cope with Trouble



EVASIVE MANEUVER

If your lane is blocked, and you discover it too late to stop, you can still take evasive action. Simply steer around the obstacle. Expert drivers are always prepared with an escape path in mind for such emergencies. In this test, the instructor gives a "left" or "right" command with only about 100 feet to spare, at speeds up to 50-55 mph. You learn your car's response to violent maneuvers and see what its limits are—all in complete safety—to prepare you should you ever be faced with a real emergency.

Learn these maneuvers, and you can forget your fear of skidding, blowouts, running off the road, and finding your way blocked

By **JAN P. NORBYE** / *PS Automotive Editor*
and **JIM DUNNE** / *PS Detroit Editor*

Can you master a skid? You probably can, to some extent. Experienced drivers usually do the right thing without even thinking about it. But do you know what causes skids, and what's really going on between the tires and the roadway when you bring the car back under control? To find out, we went to the GM proving grounds at Milford, Mich., where Richard A. (Doc) Whitworth put us through GM's Advanced Driving Course.

GM is helping high schools and universities all over the country to set up accident-avoidance exercise programs and facilities, and is training instructors at Milford. The course was created by Fraser Smithson, a proving-ground engineer, and an expert on tires and vehicle dynamics. Doc Whitworth has been a teacher and driving instructor for many years, and worked for the National Safety Council before he came to GM.

Can you take the course? The list of institutions that offer it is growing. But you can't test yourself; the exercises must not be tried on public roads. And skid control is only one part of the course. Fraser Smithson told us how the exercises were developed:

"We started with an analysis of driver errors leading to accidents. If you can avoid doing the wrong thing in an emergency, you're a safer driver. The next step is to get you to do the right thing. The driving errors that cause the highest number of accidents are improper action

Copyrighted material

If the tail skids out (short arrow on the sketch above) you can regain control by removing your foot from the gas and countersteering. Steer your front wheels so that they're pointing along your intended path. Our test car was equipped with a brake button that locks the rear wheels. Skid sequence at the left shows start of skid, control of skid, and end of skid. Sequence at right shows what happens when you overcorrect: The car's tail swings over to the opposite side of the roadway.

When You're Already In It

(or inaction) in skids, improper evasive maneuvers, improper off-road recovery, and improper braking."

Jim Dunne: "If you drive a VW, and take the course on a Chevy, won't you be worse off than before?"

Doc Whitworth: "Correction methods are the same for all cars. Front-wheel drive or rear engines, jeeps or whatever—these exercises are valid for all."

Learning skid control. "Stay off the brakes" was the first thing Doc told us. "Locked rear wheels will make you spin out. With locked front wheels you'll skid straight ahead."

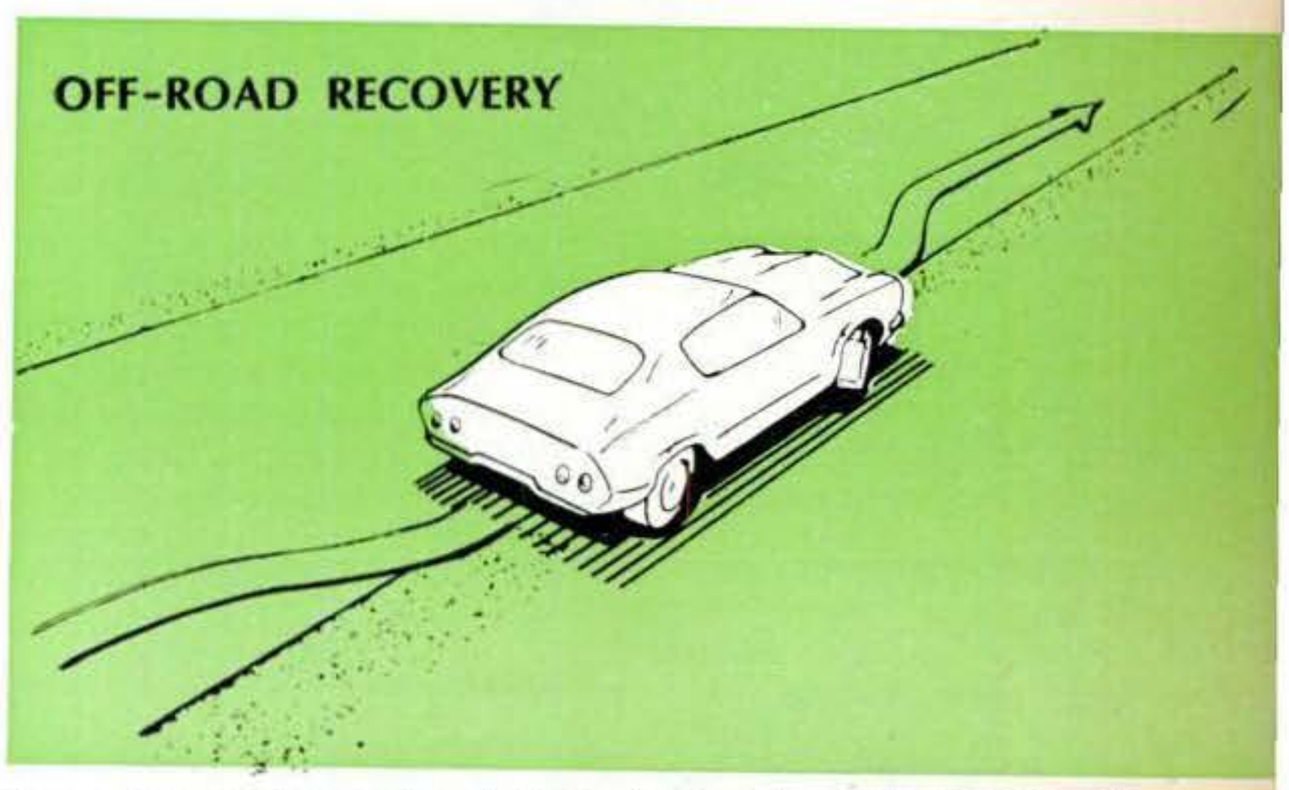
Jan Norbye: "What do you advise in the way of steering corrections?"

Doc Whitworth: "Forget what you've heard about steering 'into' or 'with the skid.' Steer where you want to go, the same as when you're not skidding."

Jim Dunne: "I've noticed that even inexperienced drivers tend to do the proper thing in most situations. It's only when you've given them rules they don't understand that they get confused and lose control."

The evasive maneuver. This exercise is intended to show you how much evasive ability your car really has.

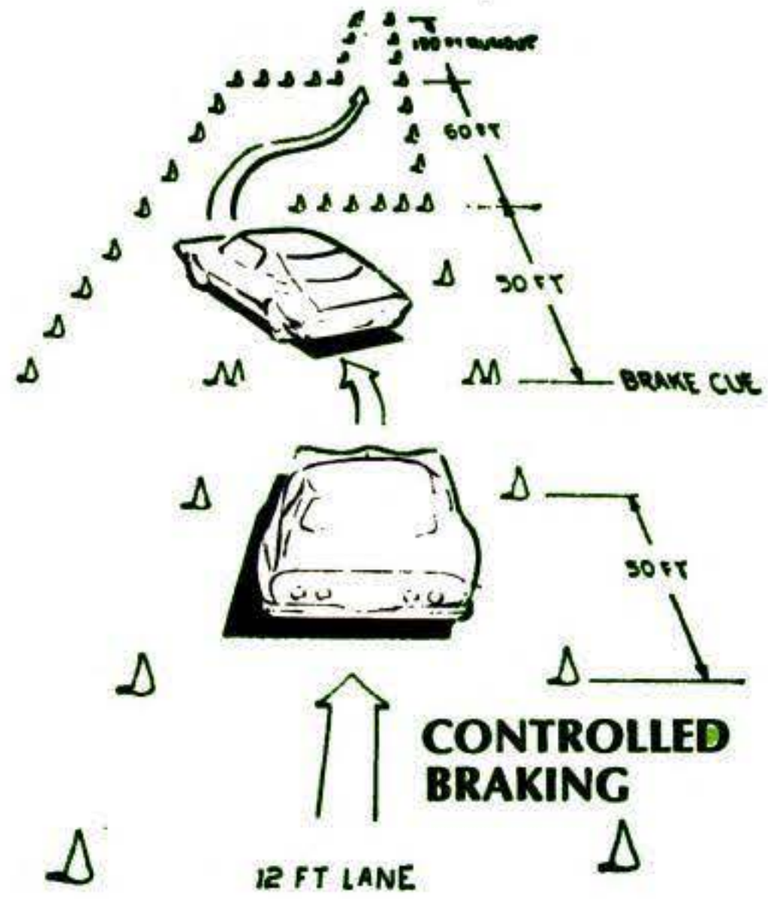
Continued



If you drive off the road, with two wheels or four, there's one safe way to get back on the highway. Lower right photo shows the wrong way. Don't ever try to ease your way back—a high curb or ridge will fight the steering, and send you into a spin. Your front wheels must approach the curb at an aggressive angle, so that their rolling motion will bring them over the ridge. Don't be afraid to crank the wheel hard, but be quick to straighten out as soon as you're back on the pavement.

Don't panic—modulate your brake pedal so you can steer all the way

When you've got to stop, search for the path that allows you the longest stopping distance. To steer around obstacles while braking is difficult, but you can learn it. Don't push so hard on the brake pedal that you lock the wheels—particularly not the front wheels. Locked wheels will skid, and cannot steer the car.



Fraser Smithson: "Many accidents occur because drivers fail to make use of the car's maneuverability. They are afraid to crank the steering wheel through large angles at high speed—yet that's what it takes."

Look at the maneuver (opening page). We took turns driving, starting out at 40-45, building to 55. At the obstacle, Doc shouted *left* or *right* at the last moment.

Jan Norbye: "I went to the right just now, even though your command was *left*—because you waited too long at the speed I was doing."

Doc Whitworth: "I saw you were set to turn right; that's why I did it. And you were absolutely correct. You've got to have a planned course. You shouldn't be driving if you don't know where you're going."

Jan Norbye: "I see what you mean. The important thing is to miss the barrier."

Controlled braking. It doesn't look very dramatic, perhaps—just a wide skid pad and rubber cones, but . . .

Jim Dunne: "Suppose there's a stalled car in your lane, with unknown obstacles beyond, and risk of oncoming traffic in the left lane. What do you do?"

Doc Whitworth: "Hit the brakes, swing around the stalled car, get back in your own lane, and stop."

Jan Norbye: "That's a tricky one. If you press too hard on the pedal, you'll skid right into the car. If you don't press hard enough, you may be going too fast to make the swing, or be able to stop in time."

Jim Dunne: "How do you modulate pedal pressure?"

Doc Whitworth: "I use the squeeze method. Press harder and harder until you get signs of wheel locking. Don't back off—just hold it there. If you get too much locking, back off momentarily, then press again."

Tire blowout. Our test car had a compressor and air tanks connected to the tire valves (photo, below left). Sudden deflation could be produced at any wheel at any time. "A tire can be flattened in 1/200 of a second," said Doc, "and pumped up again in about 20 seconds."

Doc rode as a passenger, with a little control box that triggered the simulated blowouts. We had blowouts on the straights, blowouts on curves, on front wheels, on rear wheels, but never a control problem.

Doc Whitworth: "A right-front blowout in a left-hand curve is the worst. But as long as you keep turning the wheel, you'll pull through. Many drivers turn the wheel halfway, then freeze, and watch as they slide off the road. Turn to full-left lock if you have to."

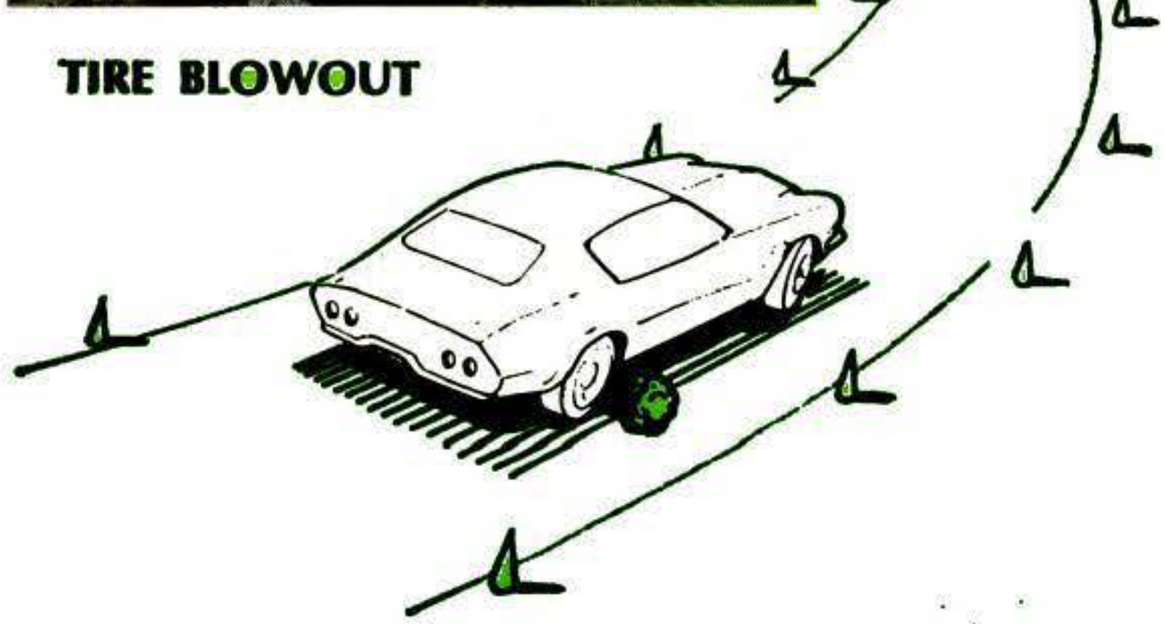
Jan Norbye: "And with a right-rear blowout you just get off the gas and countersteer, exactly as in a skid."

Doc Whitworth: "Right. And on the straightaway, there is no problem until people start wiggling the wheel instead of stopping and looking at the tires."

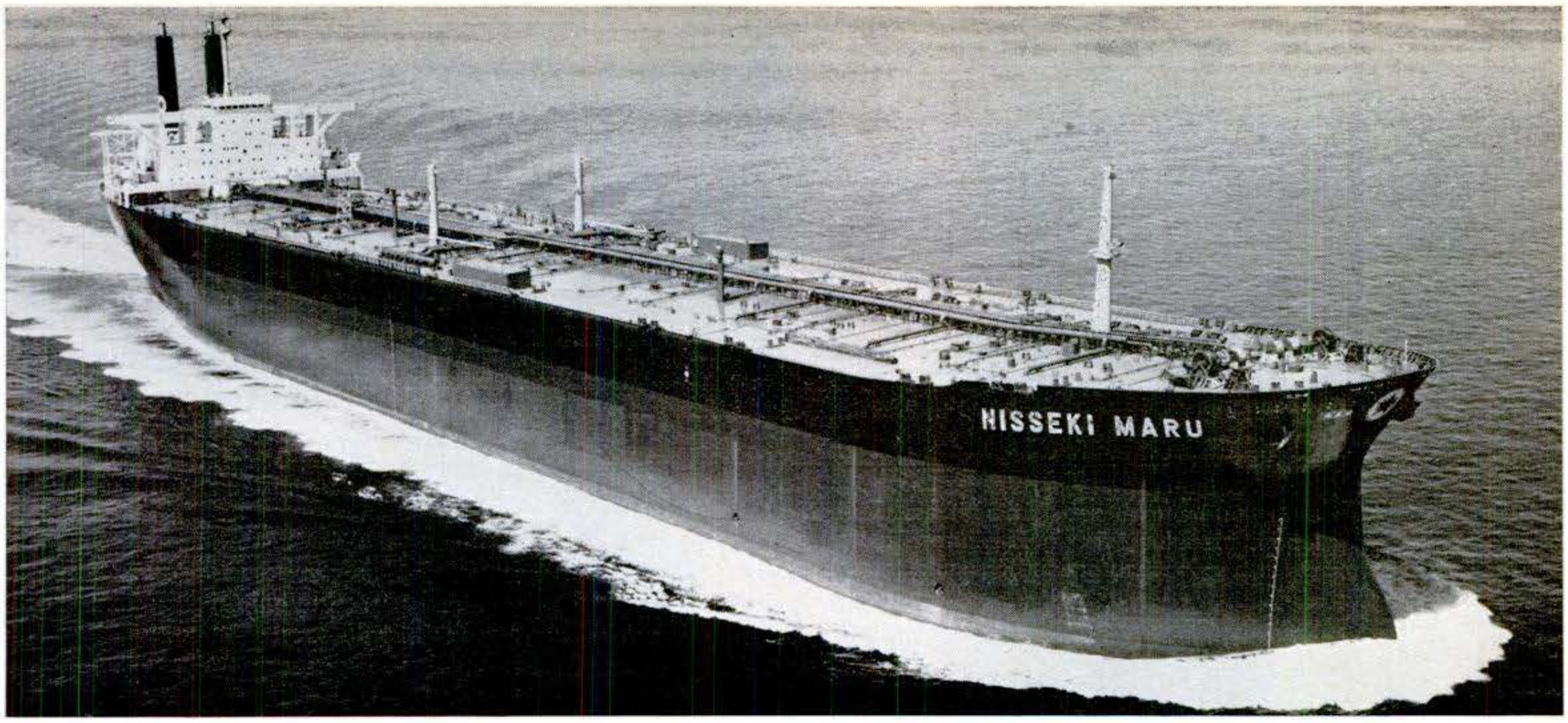
Ready for the course at a school near you? For information, write Joseph H. Karshner, General Motors Public Relations Staff, GM Bldg., Detroit 48202, or David C. Portney, Public Relations, Liberty Mutual Insurance, 175 Berkeley St., Boston 02117. PS

Blowouts are simulated with deflation gear in test car (below). Right-rear blowout in a curve, as sketched, is nothing to worry about—once you've taken the advanced driving course. Photo above shows greater challenge—a blowout while passing parked car, with a return to right lane required to miss barrier. Tail skids out, but you countersteer while getting off the gas, then apply brakes as soon as you've regained full directional control.

TIRE BLOWOUT



Copyrighted material



Plowing through calm water during sea trials, huge tanker makes fast 15 knots. Twin radar units warn crew of approaching vessels.

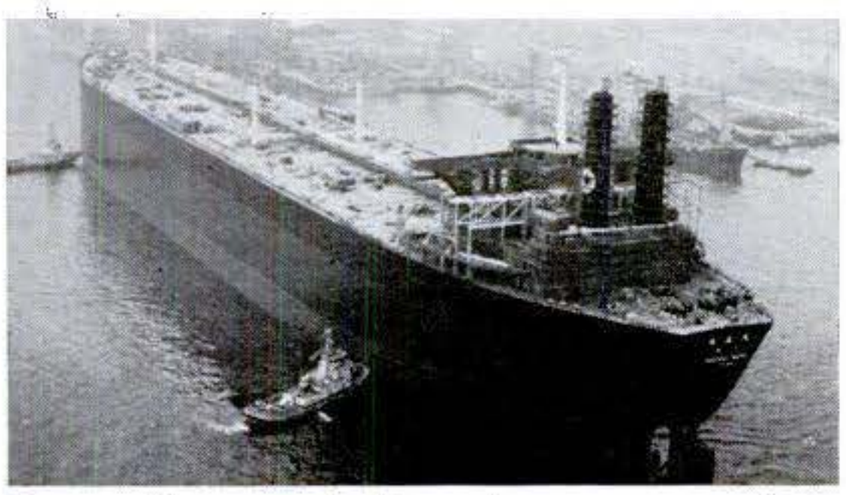
World's Largest Ship Delivers 120-Million-Gallon Payload of Oil

By MARK WALKER

New sea-going colossus—jammed with special safety gear—helps cut congestion in tanker lanes

Naohiko Watanabe commands the largest mobile man-made structure in the world. His ship, the *Nisseki Maru,* is like a horizontal Empire State Building, almost a quarter-mile long with a displacement of 19 million cubic feet!

Where can you sail such a behemoth? Her draft of 88 feet bars her from many sealanes, and none of the world's major ports can handle her. So Captain Watanabe and his 38-man crew keep her on the go between special deep-water oil depots in Japan and the Persian Gulf. They make nine round trips a year with less than 24 hours to load or unload the huge vessel.



Easy nudge out of shipyard registers on ship's slow-speed meter, an aid to prevent vessel's grounding or colliding with a quay.

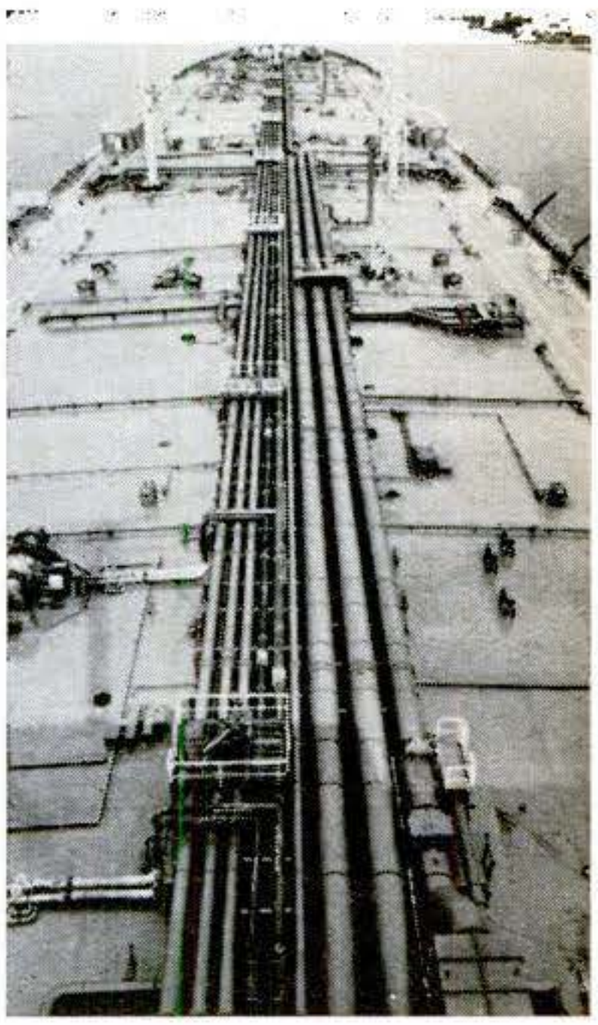
Her mission: Deliver a payload of 120 million gallons of crude oil to Japan on each trip. Converted into electrical energy, this would supply the residential needs of three million people for three months.

Ten months to build. The 372,698-ton (DWT) *Nisseki Maru* was delivered to her owners, Tokyo Tanker Co., on Sept. 8, 1971, less than 10 months from the day her keel was laid at the IHI shipyard in Kure, Japan. To achieve this astounding record, parts of the ship were prefabricated and assembled into 100-ton "blocks." The blocks were set in place by cranes, then secured and welded by crews using eight pushbutton-operated mobile scaffolds, fully equipped and running the length of the ship on rails.

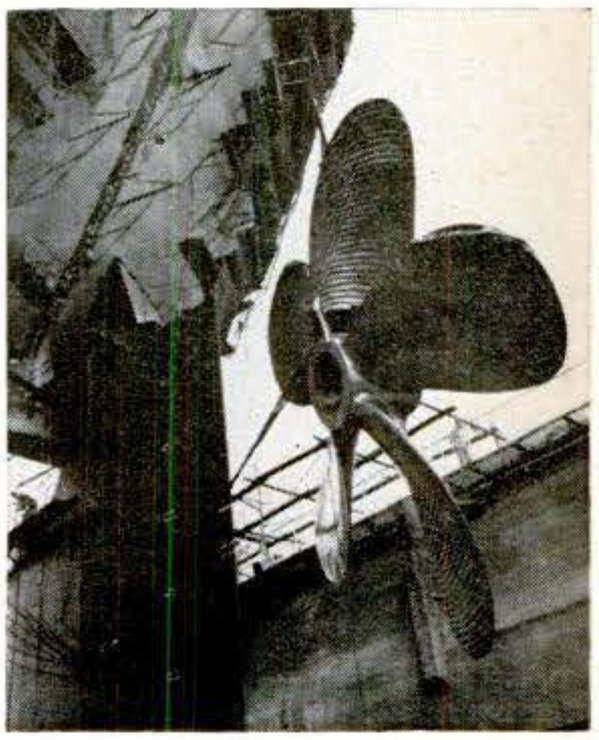
The ship is a marvel of engineering and construction. She carries 18 times as much oil as the biggest tanker afloat 20 years ago. Should you rejoice or weep? Her cargo, if loosed in the sea, could cover thousands of miles of beaches a half-inch deep in black crude oil—with incalculable damage to bird life and marine ecosystems.

But industry spokesmen contend such giants actually lessen the danger of disastrous spills. Why? Because they stick to uncongested trade routes and dock at isolated terminals; because their tremendous capacity reduces the number of ships

[*Continued on page 113*]



Oil lines run the length of the ship—one-quarter of a mile. Electronically controlled pumping keeps the load balanced.



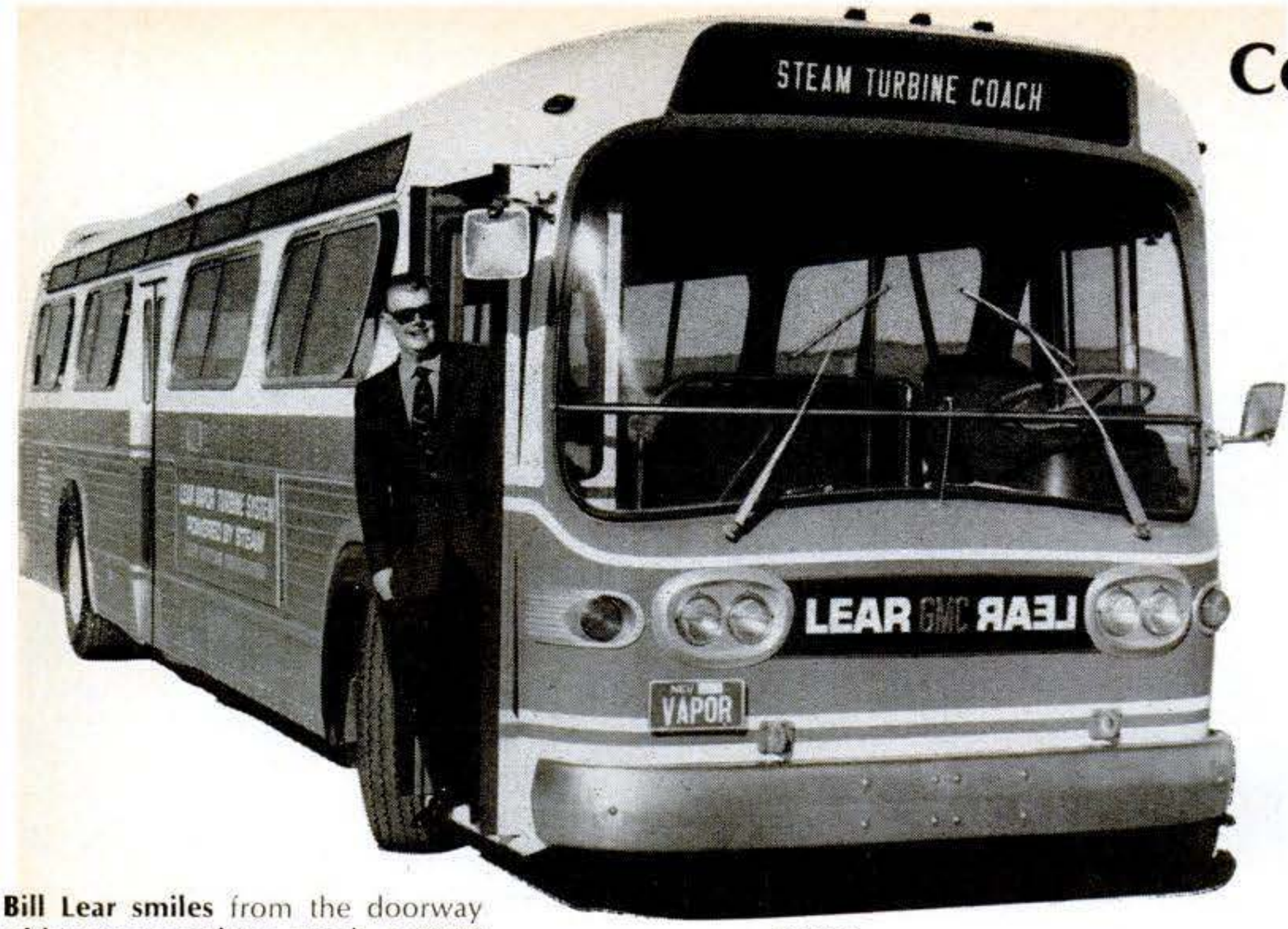
Huge 57-ton bronze propeller is swung into place. Launching of vessel at Kure, Japan, was two months ahead of schedule.

Copyrighted material

Come for a ride on BILL

A light steam turbine drives this converted bus. Will it perform reliably? Free of emissions? And how does it compare with the diesel?

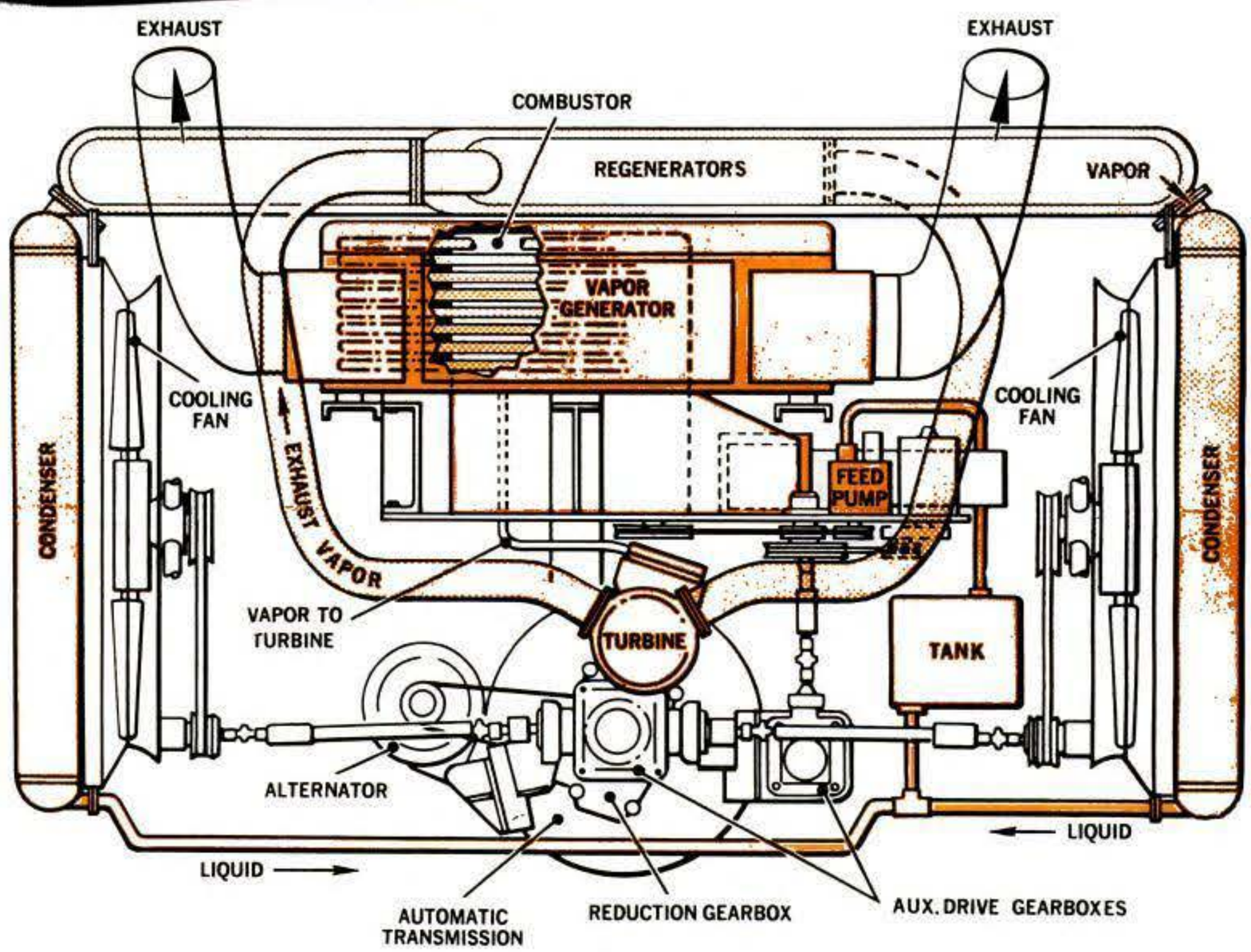
By JOSEPH P. ZMUDA

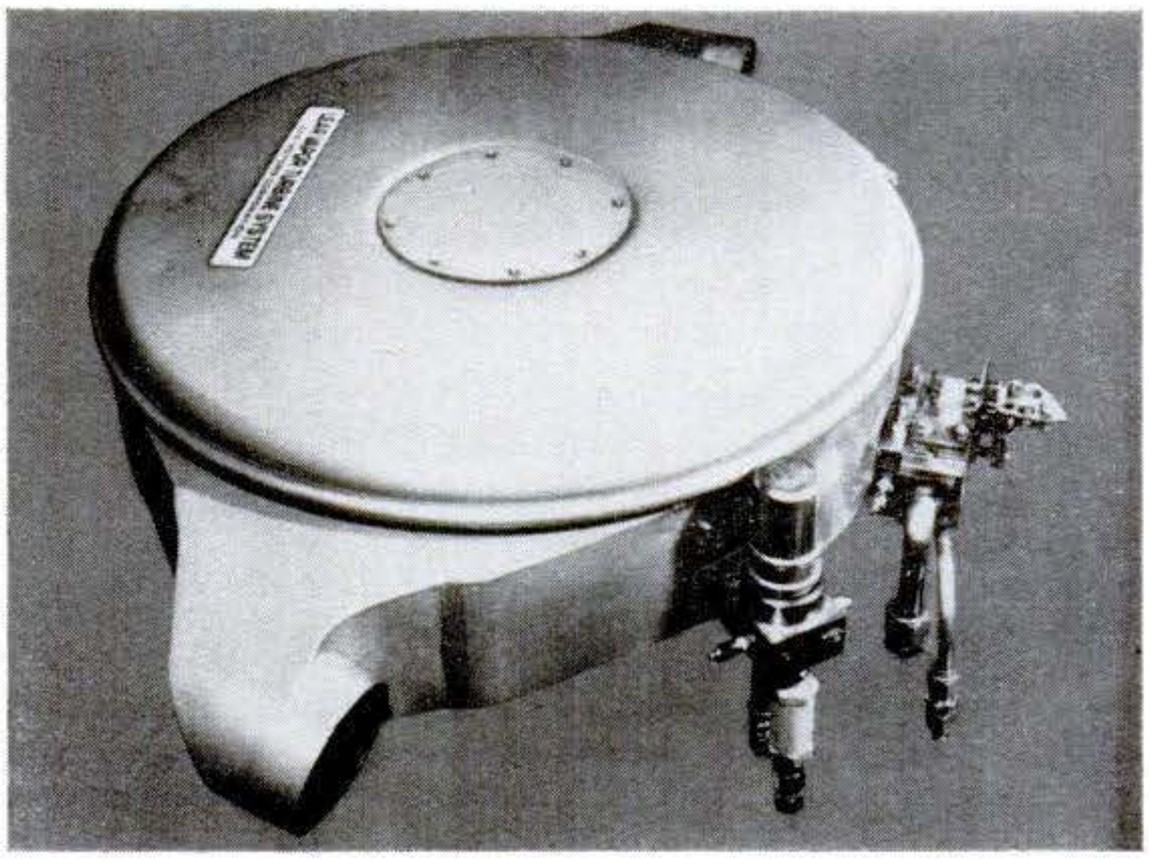


Bill Lear smiles from the doorway of his steam-turbine coach, a GMC powered by his new Vapor Turbine System in place of a diesel engine.

Water is heated in vapor generator and turned into steam at up to 1,100 degrees F under 1,100-psi pressure. Dry superheated vapor enters 5.4-inch single-stage turbine via regulating device. Exhaust vapor is ducted to regenerators.

Turbine unit is so light that Lear can hold it in his hands. Vapor Turbine System saves more than 500 pounds compared with diesel.





Vapor generator is a flat, large-diameter package containing 600 feet of special finned tubing. It weighs 600 pounds.

Copyrighted material

LEAR'S NEW STEAM BUS

At first glance, it looked just like any other GMC bus, but I soon saw the difference. As I climbed aboard, Everett Alford, who is general manager of Lear Motors, activated the engine. The first sounds were the same as in battery-driven electric cars. This was a surprise to me, but I now know the reason:

Four electric motors cut in when the system is turned on. One drives a supercharger to inject water into the feedwater pump, another is a large starter motor that drives the feedwater pump and propels the combustion blower. The third one drives the fuel atomizer, and the fourth powers the fuel pump.

The next thing I heard was a muffled roar from the vapor generator. At 600-psi steam pressure, the idle jet in the turbine opens. When the turbine reaches 20,000 rpm, an overrunning clutch drops the starter motor out of the system, and the turbine takes over completely. To warm up the engine, Alford engaged low gear and kept the brakes on. Just like internal combustion engines, the Lear Vapor Turbine warms up faster under load. After about a minute and a half, temperature and pressure had stabilized, and the bus was ready to run.

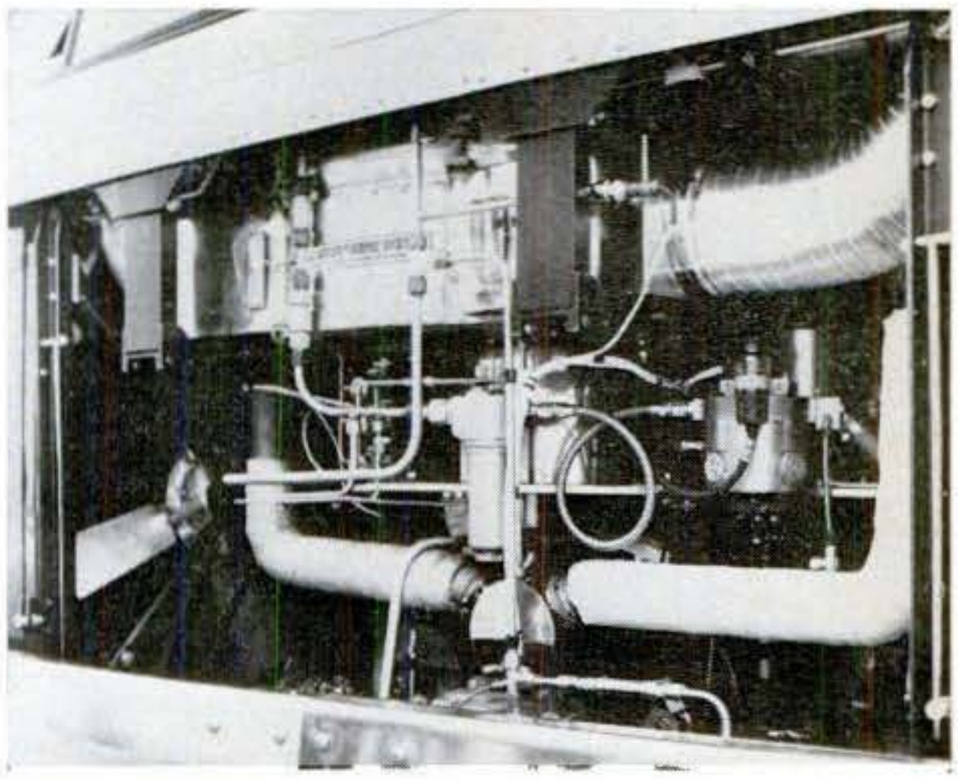
Letting her out. Once out on the 1.3-mile north/south runway of the old Stead Air Force Base, I found out about the acceleration in this power system. With Alford at the wheel, we went from zero to 30 mph in 16 seconds. With a standard diesel, that takes 28 seconds. With standees on the bus, the driver will have to go easy on the "gas pedal." Wide-open-throttle starts would send them sprawling in the aisle.

The transmission on this bus had not been adapted to the turbine. It's a four-speed planetary transmission with a hydraulic torque converter. As the turbine spun up between 40,000 and 60,000 rpm, the transmission made an upshift under full torque, and there was a severe jerk. Lear Motors' chief engineer Hugh Carson admitted that was a problem, but one that won't stay uncorrected. Before the bus is released to the San Francisco Municipal Railway for long-term passenger tests, a dummy load will be installed on the transmission.

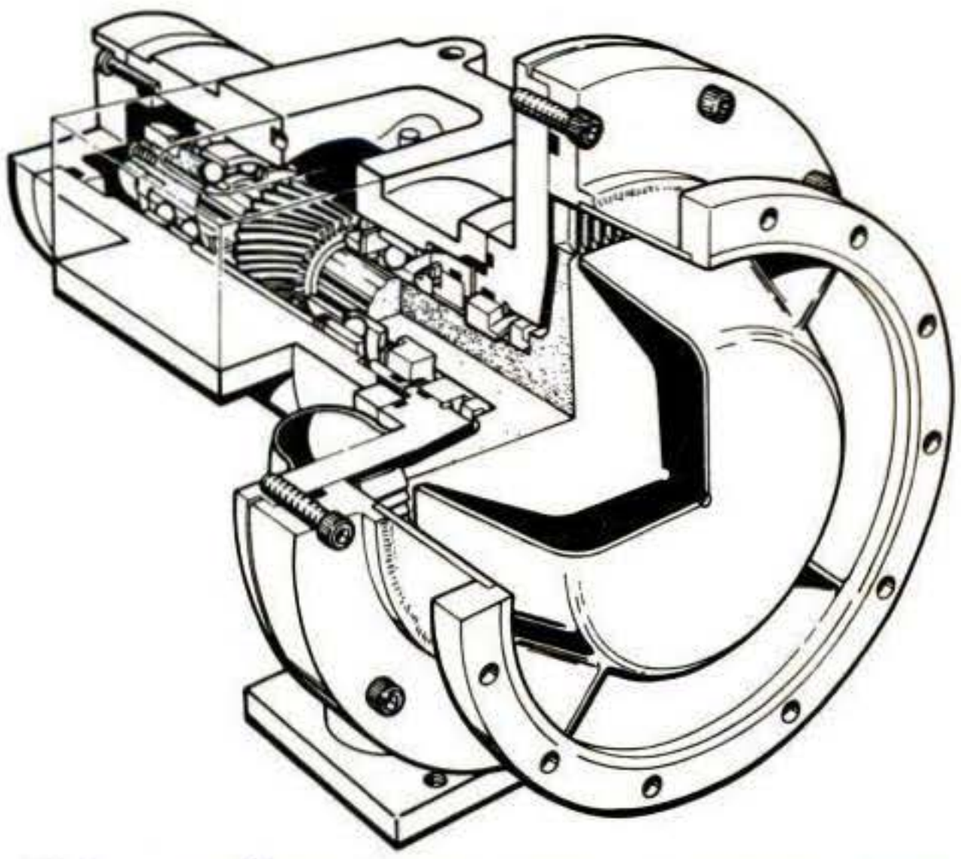
A better solution might be a stepless transmission, such as the toric drive used in General Motors' RTX bus [PS, Sept. '69] or electric drive (commonly used in both diesel and gas-turbine earthmovers).

Running at steady speeds, the Lear bus was quiet. Pass-by noise measurements, said Carson, gave readings of 74 dbA or about half the noise level of a diesel. Inside the bus, I heard the usual me-

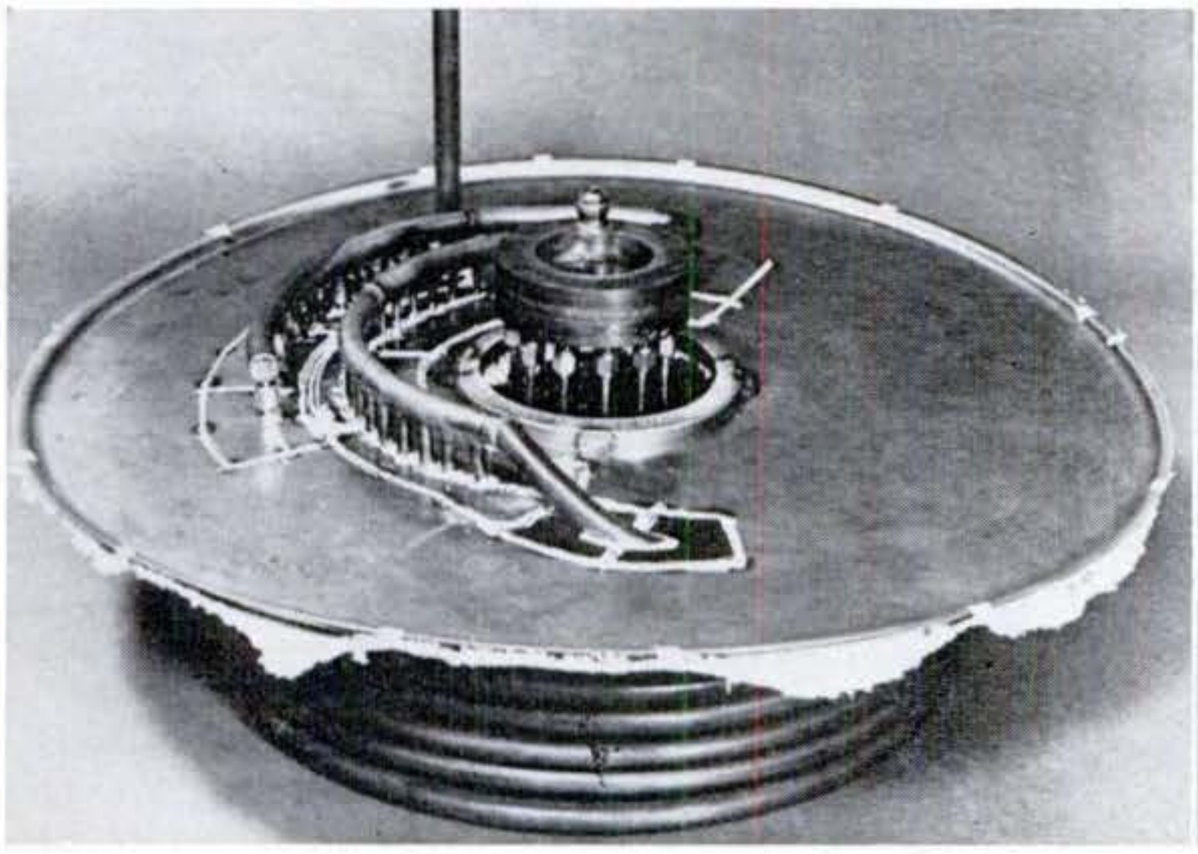
Continued



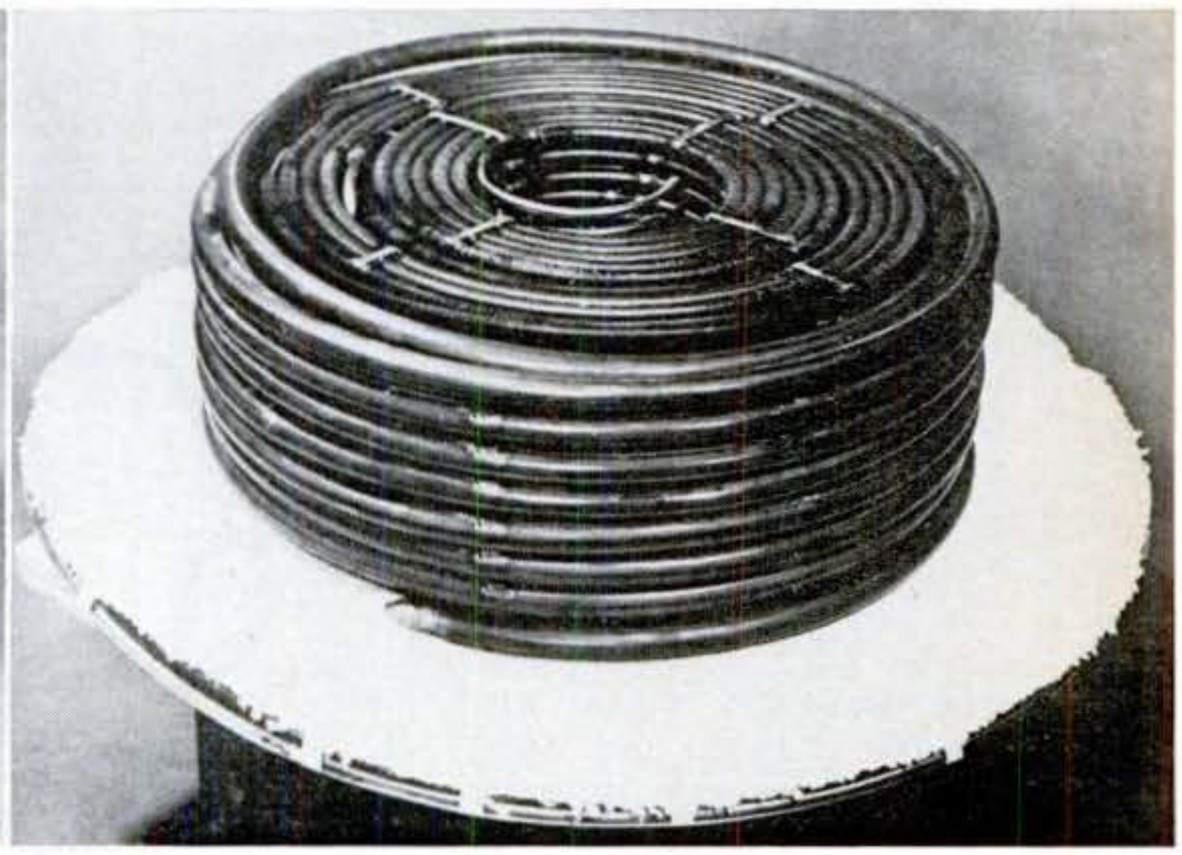
Vapor Turbine System is installed in tail end of the bus. Turbine itself is at the bottom in the middle, driving the rear axle via an automatic transmission.



Miniature turbine spins at 16,000 to 60,000 rpm, drives through 20:1 reduction gearing. Lear claims production of more than 220 horsepower.

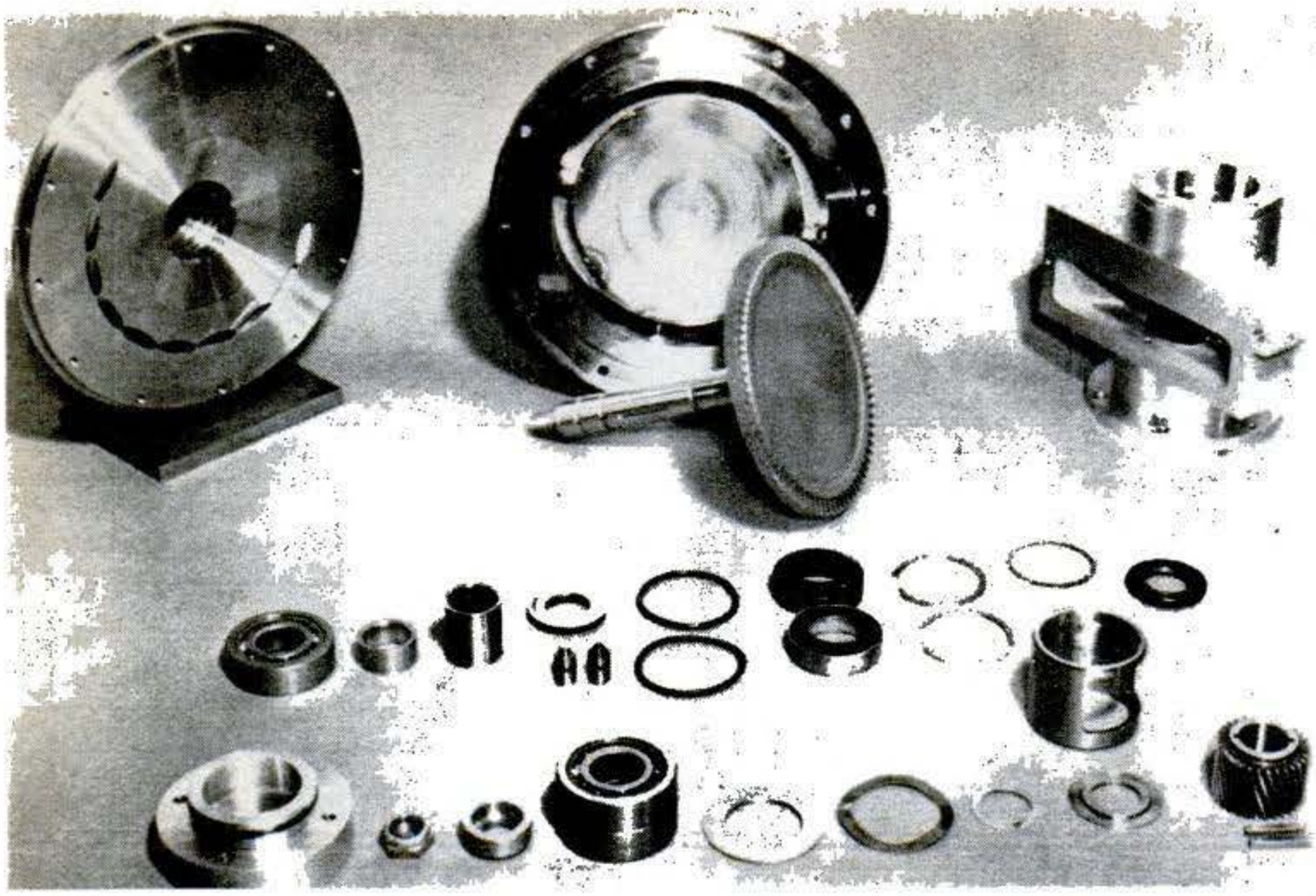


Inside the vapor generator (upside down) you can see input end of the pipes that feed water to the boiler.



Pancake coils of vapor generator (right-side up): Tubing has eight times the heat-transfer surface of ordinary pipe.

Copyrighted material



Turbine unit dismantled exposes the precision-made axial-flow turbine (at center in background) with its bearings and flanges, and its shaft and housing parts.

chanical sounds, but at a reduced 61 dbA (the level of a man's voice in a business office).

I wondered about deceleration with the turbine and how much braking effort would be needed to stop the bus. As it turned out, the windage (or resistance of the steam to the turbine rotation) on closed throttle produced about the same retardation that compression loads do in a diesel engine. Alford removed his foot from the accelerator, touched the brake pedal lightly three or four times, and brought the bus to a smooth halt in a simulated passenger zone.

Top speed? We had a strong headwind, and peaked out at 42 mph. Alford said that the bus reached 53 mph with a full load in other tests, but it takes about two miles of straightaway to build to full speed.

Is it clean? The Vapor Turbine System has undergone the California test cycle and its emissions are well within the stringent '75 limits:

Hydrocarbons	0.10 gram/mile
Carbon monoxide	2.00 grams/mile
Oxides of nitrogen	0.35 gram/mile

It's the continuous burning process and low burning temperatures inherent in external combustion engines that assure such full combustion.

What fuel is used? The Lear engine will burn any liquid hydrocarbon fuel. "That includes," said Carson, "automotive and aviation gasoline, kerosene or diesel fuel—or any mixture of them." Most tests were run on JP 5 jet fuel, chosen for its similarity to kerosene. Identical results were obtained with No. 2 diesel fuel, however. But fuel consumption is high: 0.9 pounds per hp (0.40 to 0.45 is normal in diesel engines).

Now for the working fluid: It's water. Carson explained that the Lear organization experimented seriously with certain organic fluids such as fluorinated hydrocarbons of the Freon family, but they all invariably broke down into noxious and corrosive substances when subjected to the vagaries of a high-temperature steam system. At last, Lear went back to tap water—but without providing a means to get around the freezing problem if the bus gets stalled in cold weather.

Why the turbine? Why did Lear choose it rather than a piston-type expander? Because it allows tremendous steam velocities. The Lear turbine always maintains its maximum steam pressure at the nozzle inlet, and it drops to about 20 psi in the gap between the admission ring and the turbine blades, where steam velocity approaches 5,000 feet per second! This is important, because it is specific impulse (a product of mass and velocity) that delivers the torque.

The turbine is miniaturized, with a diameter of only 5.4 inches. The entire turbine unit, with its 20:1 reduction gearing attached, weighs only 98 pounds. The turbine rotates between 16,000 and 60,000 rpm. Power output? Lear claims over 220 hp!

After doing its work, the steam is routed to two radiator-like condensers on either side of the engine compartment. Measuring 34 by 40 inches, and cooled by two 34-inch-diameter fans, they are capable of condensing all the steam produced by the vapor generator. The condensate returns to the feedwater tank for recycling.

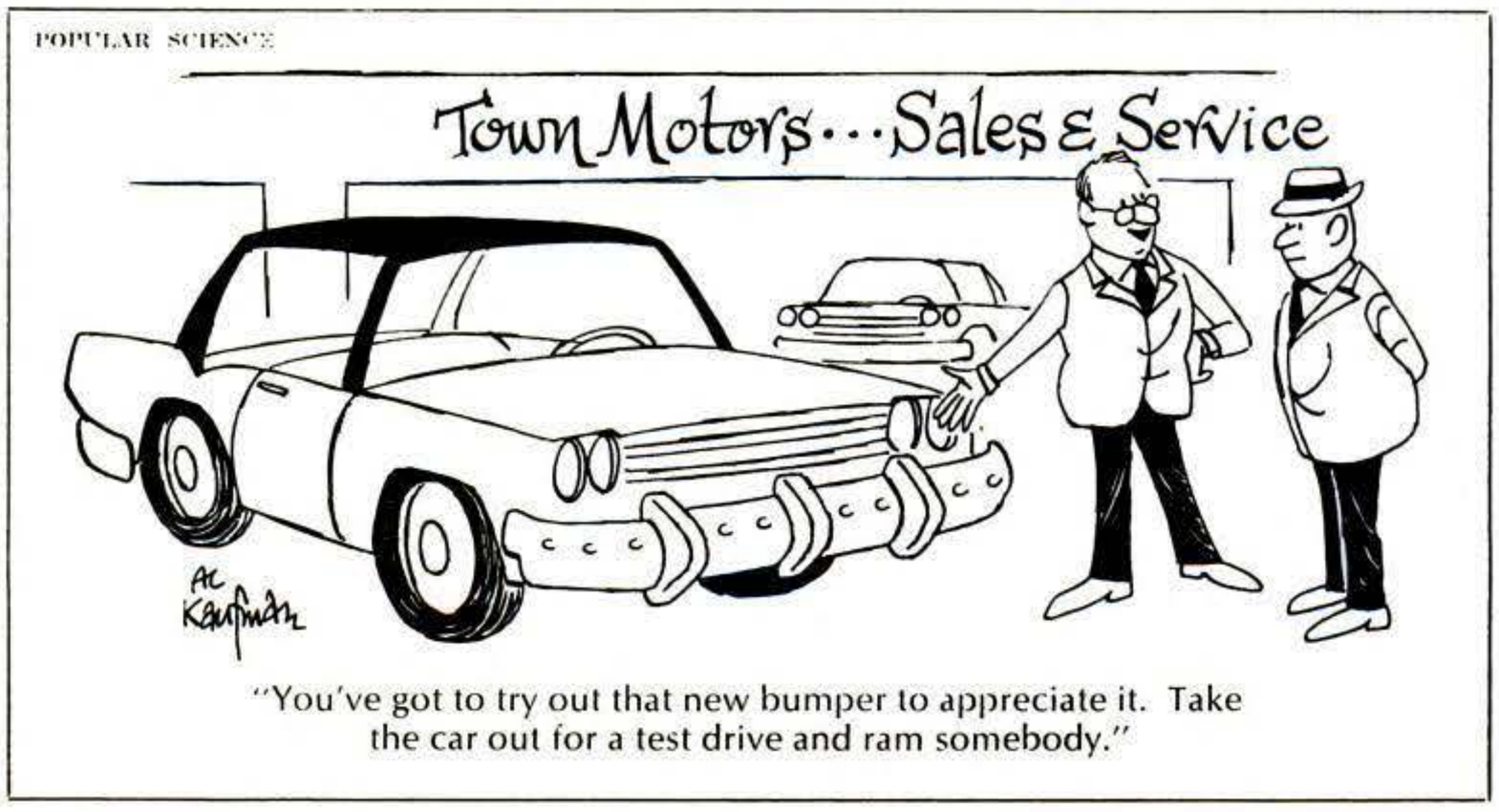
Building up the heat energy. Borrowing a trick from large power plants, Lear installed heat regenerators between the turbine steam exhaust and the condensers. The idea is to recuperate heat energy stored in the vapor and use it to preheat the feedwater. The regenerators consist of long runs of pipe in tight metal jackets, and can give a heat-energy saving of up to 15 percent.

Under certain conditions, the condensers can also act as radiators, cooling the condensed water far below the optimum 200 degrees F. To prevent undesirable radiation, a servo control is attached to louvers over each condenser. When temperature drops below 190, the louvers snap shut.

The feedwater pump, belt-driven from the turbine, has a maximum speed of 1,800 rpm. It's a four-plunger pump with a movable diaphragm that provides a variable stroke. This way, feedwater supply can be varied to match the precise demand.

I was excited about my ride on the steam bus and the technology that went into the bus. But it's obviously not the ultimate in steam power.

"There's still lots of work to be done," Bill Lear confided to me. "We've made tremendous progress toward an economical vapor system. And with the expenditure of sufficient money over another two to three years, we are certain that we can boost its efficiency to equal that of present diesel engines." PS



"You've got to try out that new bumper to appreciate it. Take the car out for a test drive and ram somebody."

Copyrighted material

"Landside" terminal building (center) at Tampa International is connected to four satellite buildings by shuttle system. Its main terminal has six tiers including one with an elevated roadway for quick access to ticket counters and baggage checking.

Now They're Building

Airports That Take the Hassle Out of Catching Your Plane

Soon you'll drive right "through" the airport, park only a few hundred feet from your jet, and zip through the terminal on "horizontal elevators"

By JOHN GOODRUM

Your plane leaves in 15 minutes, and you're still five miles away from the airport. "I'll never make it," you moan. But you stay right on the main highway and a few minutes later you pass several terminal buildings on either side. You spot your airline, drop your bags, park, and board your plane—all in less than 650 feet. You made it with five minutes to spare.

Sounds unbelievable? Maybe today, but in a few years that's how easy it'll be to get to an airport. No more walking long distances from parking lots, no more count-

Continued

Shuttle system has two cars on each roadway. Each vehicle takes 125 passengers and carries them from landside terminal to airside departure and arrival lounges. Cars work reciprocally, are fully automatic, and can make the trip in about 40 seconds.

Copyrighted material

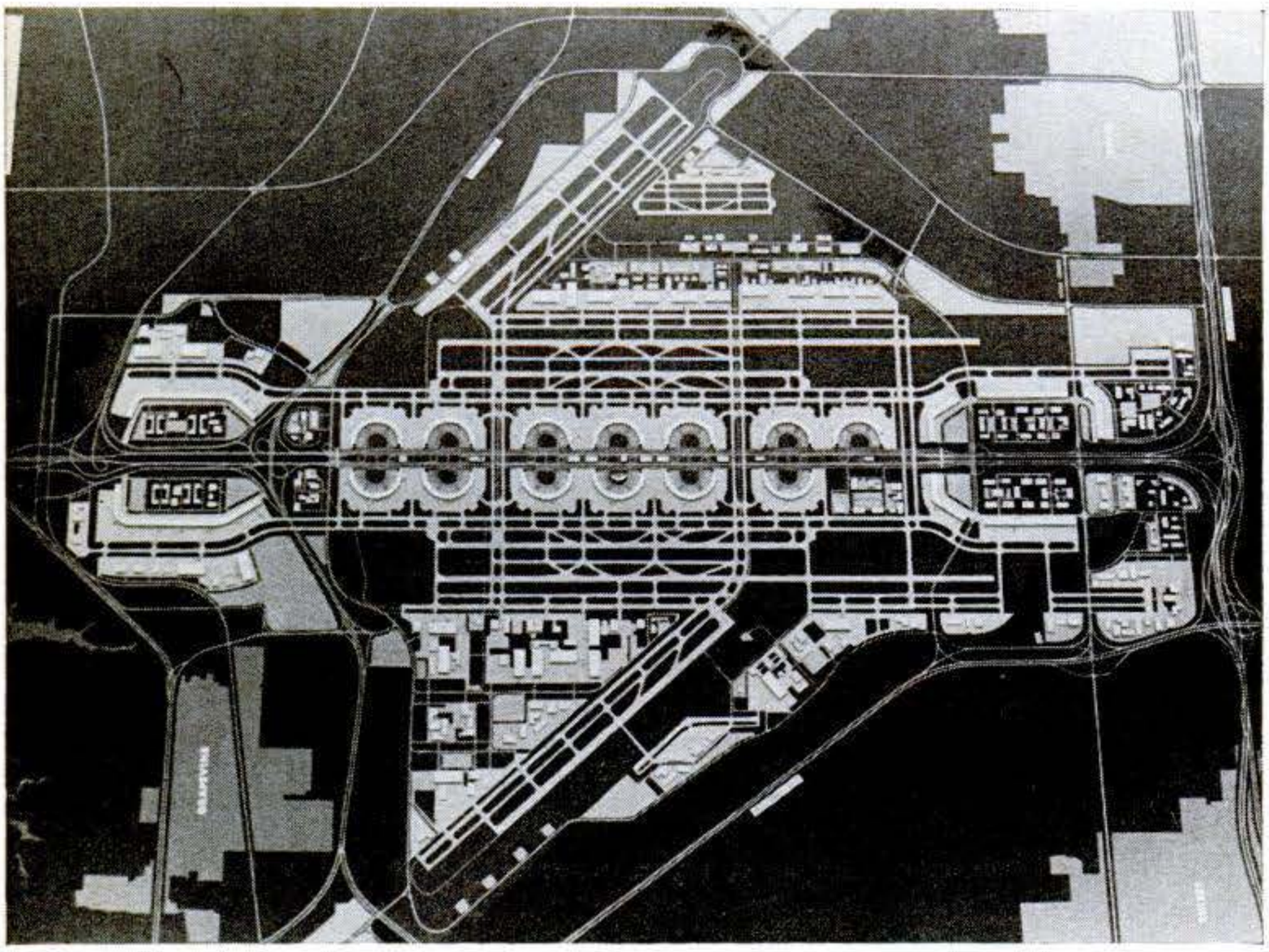
The new Dallas-Fort Worth Regional Airport will be larger than all three New

less hours of waiting, and no more struggling with luggage at the airport of the future.

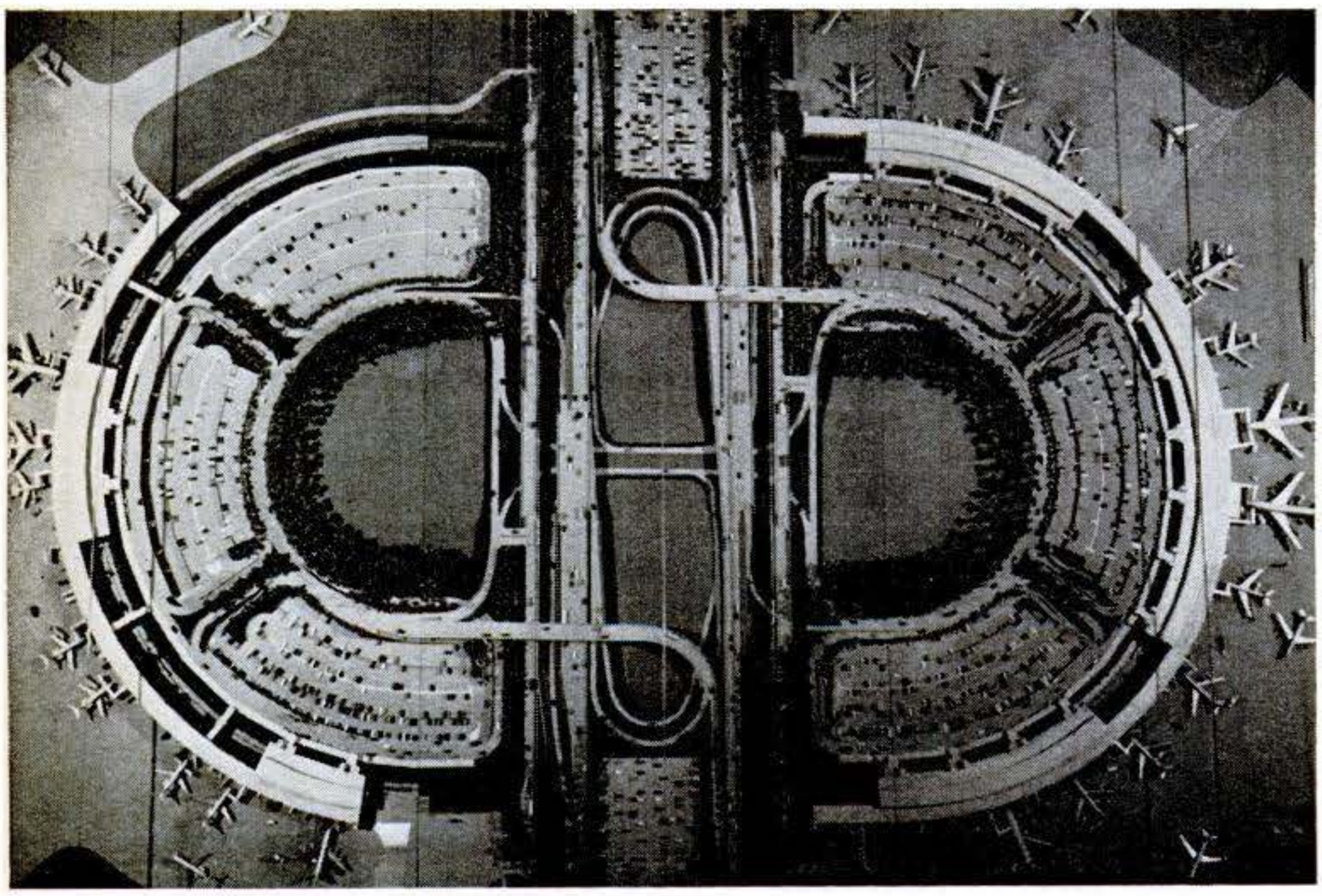
Let's take a trip to three of the newest airports—the giant Dallas-Fort Worth Regional (which will receive its first plane in mid-1973), Kansas City International (scheduled to open this fall), and Tampa International (opened last year).

Admittedly, I first looked at these airports with the jaundiced eye of an air traveler who has suffered enough. But I'm happy to report that good things are shaping up fast—especially at the Dallas-Fort Worth airport.

Recently, I drove across the huge 17,000-acre airport which sprawls across gently rolling Texas hills almost exactly equidistant from Dallas and Fort Worth. Scores of bulldozers and earthmovers are clearing land away, but the control tower is finished and subgrades for runways to handle jets up to three times the size of a 747 are also completed.



Artist's conception of Dallas-Fort Worth Airport, as it will appear in the year 2000, reveals a total of 13 terminals; several runways. Mammoth complex will move 55 million people annually and more freight than today's busiest seaport.



Two "half-moon" terminal buildings at Dallas will enclose parking lots bigger than a football stadium. Network of roadways connects two terminals and main highway. Extra parking during peak load periods is available between highway lanes.

Key to the airport is the International Parkway—a superhighway running through the heart of the complex. This, too, is taking shape. It will whisk traffic quickly in and out of the airport.

Takeoff from Texas. On International Parkway you follow the airline signs to your aircraft gate. (You telephone ahead for your departure gate for most effective use of the airport, but continuous broadcasting of flight schedules is under study now.)

Approaching your airline terminal exit at 55 mph, you'll see a 40-foot pylon with your airline's insignia. Exit signs guide you off to the left. A highway-interchange turn radius will slow you down to 30 mph as more-detailed signs guide you to the enplaning roadway. You'll check your bags at curbside, park not more than a few hundred feet from your plane—and you're off.

Homing in. You'll deplane at second level, pick up your bags a few feet away, and walk out a doorway leading to the deplaning roadway or down to the lower-level parking lot. That's about as close as we can expect to bring surface and air travel.

If you return to a different terminal than the one you departed from, it'll still be a cinch to get to your car. You'll board a "horizontal elevator" called Airtrans ["Personal Rapid Transit," PS, Nov. '71]. An updated, computer-operated version of the street car, Airtrans is considerably faster and more comfortable. It will take you from one airport terminal to another in an average of six minutes, including waiting. Airtrans may also be used for public transportation between Dallas, Fort Worth, and the airport.

As I looked around, I could see the rough skeleton of what will be larger than all three New York airports combined. Ultimately, there will be 13 semicircular terminal buildings located along the sides of the main artery. At first, only four terminals will be in operation, but even then the airport will be bigger than Kennedy.

I walked into a terminal building. Already I could see that the typical noise and confusion of today will be gone. For one thing, the building is big. If necessary it can be widened or another deck can be added. This airport is designed to accommodate the anticipated traffic load for the year 2000.

The Dallas-Fort Worth complex will be the world's first airport officially designated as accessible to the handicapped. I noticed space for extra-wide parking spots near the front of each terminal, reserved for handi-

Copyrighted material

capped travelers. Special ramps and elevators will be installed for wheelchairs. Elevator buttons will have Braille designations and a recording will announce the floors. Flashing fire-signal lights are being installed for the deaf.

I went from the terminal to the 200-foot control tower. At the top I could see both Dallas and Fort Worth, and the sprawling complex around me. This airport will have a huge people-moving capacity. That's fine. But what about all those extra jets needed to move them?

Lots of runways. Six are being built for scheduled commercial operations. They will be handling between 180-260 movements in the peak hour. There are four running north-south, the longest 11,400 feet, but easily extended if the need arises. There's also a 9,000-foot crosswind one. Each runway is designed to accommodate the largest aircraft that's now under consideration.

I noticed several high-speed turnoffs on runways. They should help speed up aircraft traffic movements to and from parking aprons and gates. And since the planes park nose-to-terminal, your jet will never have to wait for another to move before it can leave its departure gate. This will eliminate ground traffic jams like those I've encountered at Washington National and Newark.

To accommodate short-haul transportation, a separate STOL facility will be built ["QUESTOL: A New Kind of Jet for Short Hops," PS, May]. It will have two 2,500-foot runways and an additional 5,000-footer for private and corporate aviation. And eventually, at the end of each passenger terminal complex, there will be huge cargo terminals capable of handling 200 jumbo jet freighters simultaneously.

At Kansas City. Will this "gate arrival" concept really work? The system will undergo thorough testing this summer at Kansas City International. Here, if you use public transportation, you will walk about 150 feet from a bus or cab to your airplane. Park your own car, and you'll only need to walk about 300 feet.

Kansas City's new airport (above, right) spots two-story circular terminals in a three-leaf-clover arrangement around the tower and administrative complex. Each terminal structure is 65 feet wide and 2,300 feet in circumference, and has 15 gates.

Kansas City and Dallas-Fort Worth both use the same formula. There is another alternative:

Tampa—a different concept. At first glance this airport appears to be just a new version of the conventional jetport with its congested central terminal building and "fingers" extending outward to departure gates. But this appearance is a deception, for Tampa may well be the most passenger-oriented terminal complex in operation today.

The "landside" terminal building at Tampa made air travel a real pleasure for me. With ticket in hand I took an escalator to the third level where I found restaurants, snackbars, shops, and spacious lounges. I walked a short distance to a passenger transfer point and boarded a waiting shuttle vehicle. The doors closed quietly behind me and the car began to move. Just 40 seconds later the doors opened again. I stepped out into a compact "airside" building, and walked a few feet to my jet.

New shuttle system. Westinghouse Electric's shuttle system is the heart of this radically different elevated transit system. Two shuttle cars travel each of the four legs that connect the central building to the satellite arrival and departure buildings. The system has a capacity of 5,000 passengers an hour.

Two additional satellites can be added to the main terminal to increase traffic flow up to 50 percent. And the central building can take another three floors of parking to boost capacity to 4,000 cars.

The general prescription of the new airports seemed to be massive expansion—always with plans to expand some more if needed. And it's clear that ground and air transportation will be closely tied together with better planning and the development of rapid surface transit. Dallas-Fort Worth Regional is showing the way to drawing downtown closer.

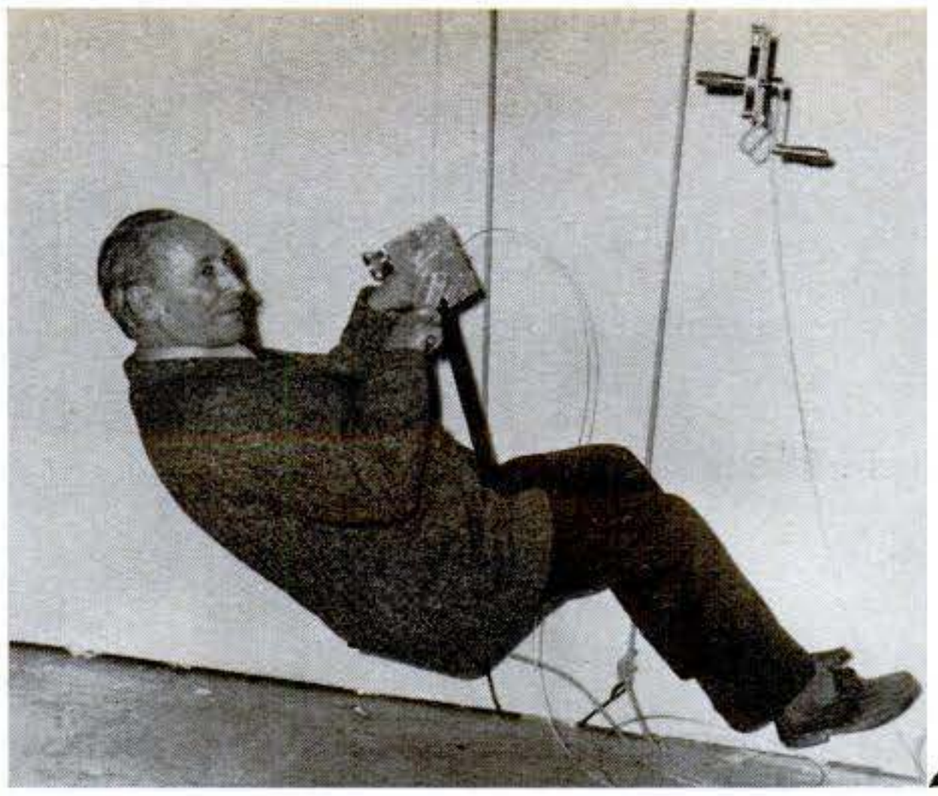
But what about the prospects of other high-capacity airports? There are some problems: opposition from environmentalists, scarcity of land near metropolitan areas, and rising costs. Air travel, however, is here to stay and increasing by the day. The only solution in sight is to expand our existing airport facilities or build new ones. Let's hope we do both. PS

Three terminal modules surround control tower and administrative building at Kansas City International. Aerial photo taken last spring also shows high-speed turnoffs on runways at lower left and right. Parking is at center of modules.

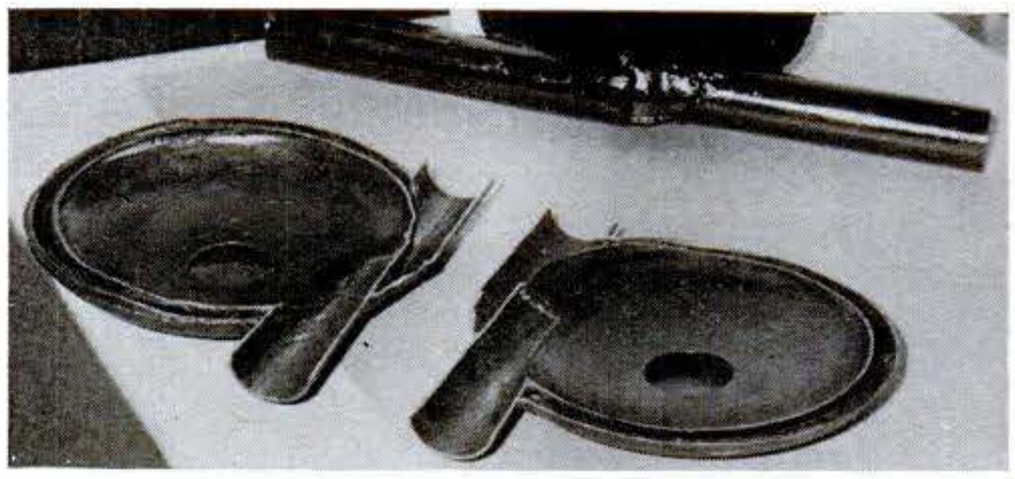
Architectural model of single terminal at Kansas City depicts "gate arrival" concept. Initially, central area will have 900-car capacity. Tri-level expansion (2,700 capacity) is in works. Shuttle buses will handle inter-terminal travel.

Copyrighted Material

Rowing machine for boat uses propellers, letting you face direction of travel. Hand levers are coupled to large primary gears by a one-way clutch. Flywheels on the secondary gears turn props between strokes. To steer, you pull one side harder.

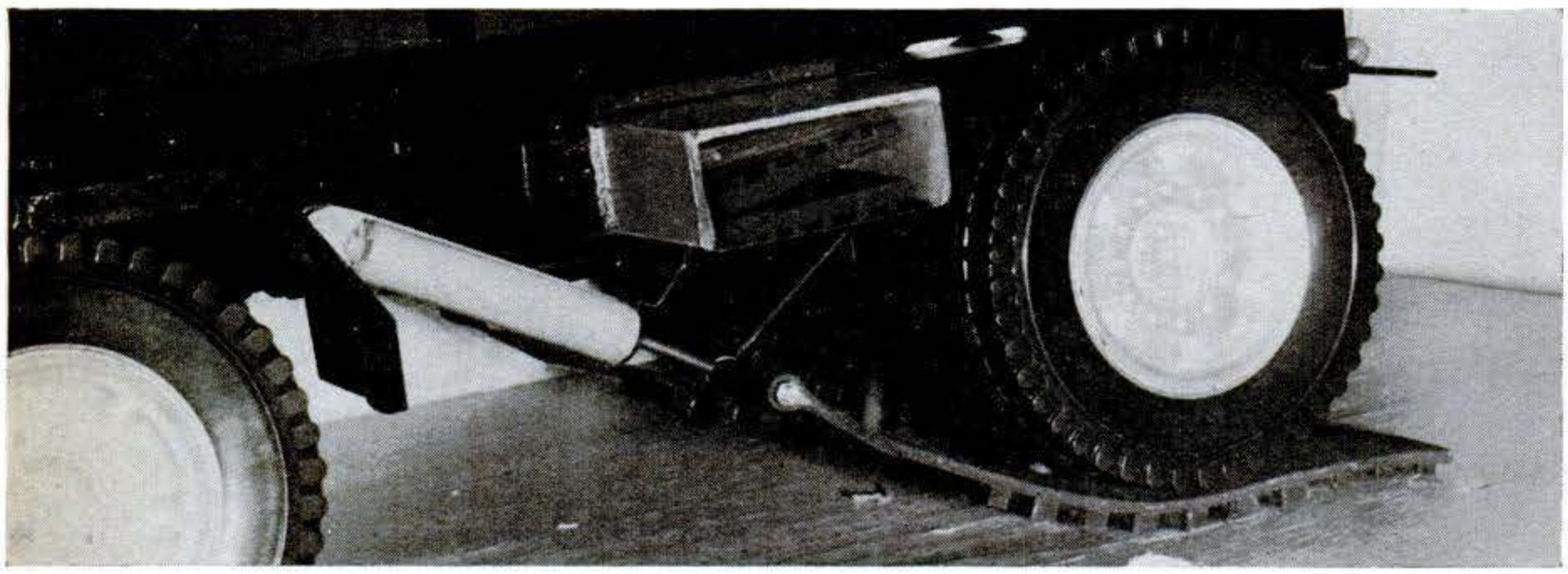


Cable-hung fire escape lowers you to safety as you turn a crank. Three knob-adjusted rollers change cable drag for weight adjustment. Cable then wraps around cranking drum, which has two pinch rollers to hold tension.

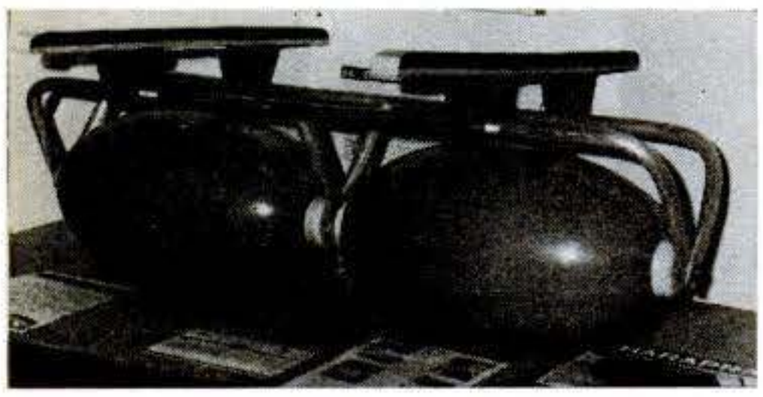


Exhaust afterburner on engine manifold cuts carbon monoxide emission and eliminates muffler. Exhaust feeds into inner chamber, swirls through holes into outer chamber, is mixed with air and ignited by a spark plug.

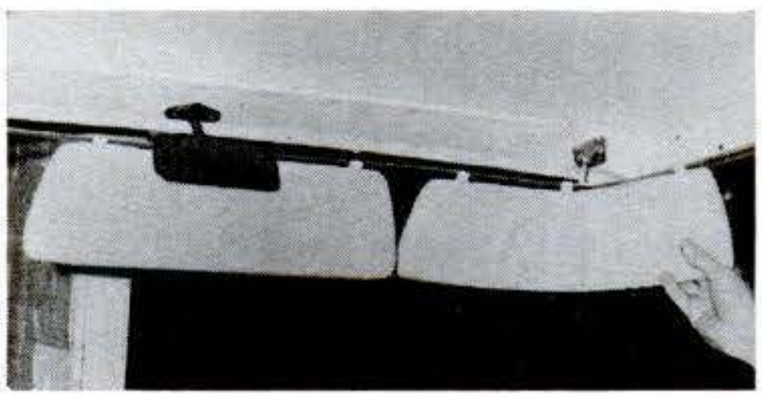
13 new gadgets from the 21st INTERNATIONAL



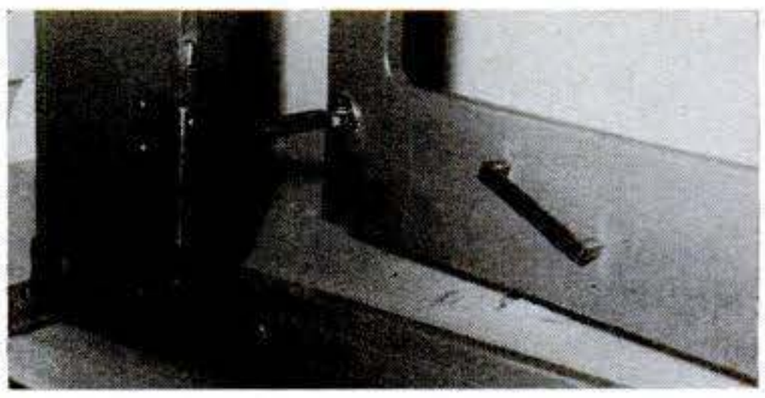
Skid pads drop beneath rear wheels to stop runaway trucks on hills. If the brakes fail the driver pulls a lever and the pads drop down and are drawn under the wheels. Pivoting arms hold the leading ends and hydraulic dampers absorb shock. The hinged pads fold into a box when not in use.



Boat rollers carry heavy loads on sand or mud flats without digging in. The elongated low-pressure balloons are inflated like footballs. The hull is supported by molded pads clipped on the aluminum frame. With pads removed, frame folds flat to store.



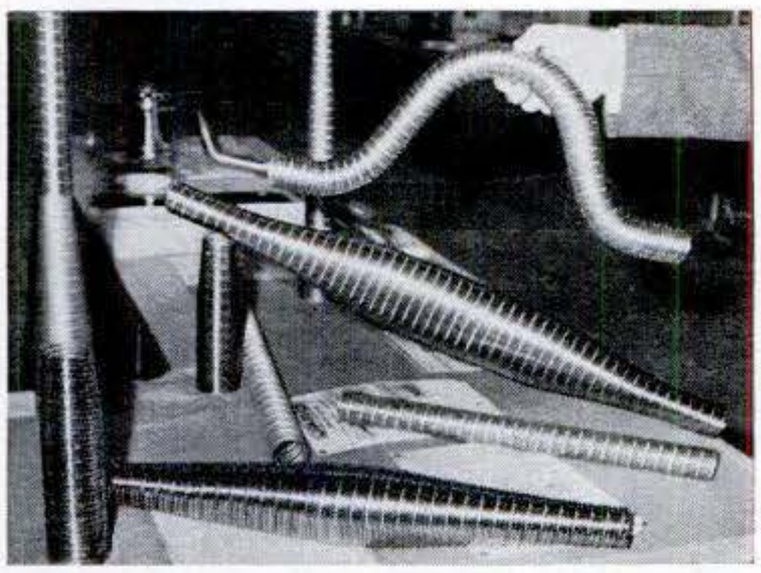
Flexible sun visor bends around corners, slides behind mirror, or takes any position along U-shaped rail above windshield. Nylon clips lock to rail so visor parks firmly against the roof when not needed. Additional visors can be attached.



Safety catch for car doors limits opening to five inches until you're sure passing traffic is clear for a wider swing. Hook on hinged arm automatically engages when door is closed. Arm retracts into housing when released to open door wide.

Copyrighted material

Self-cleaning mirrors rotate circular reflectors against fixed blades. Manual unit (left) has rack-and-pinion drive; electric model (right), a high-torque motor.

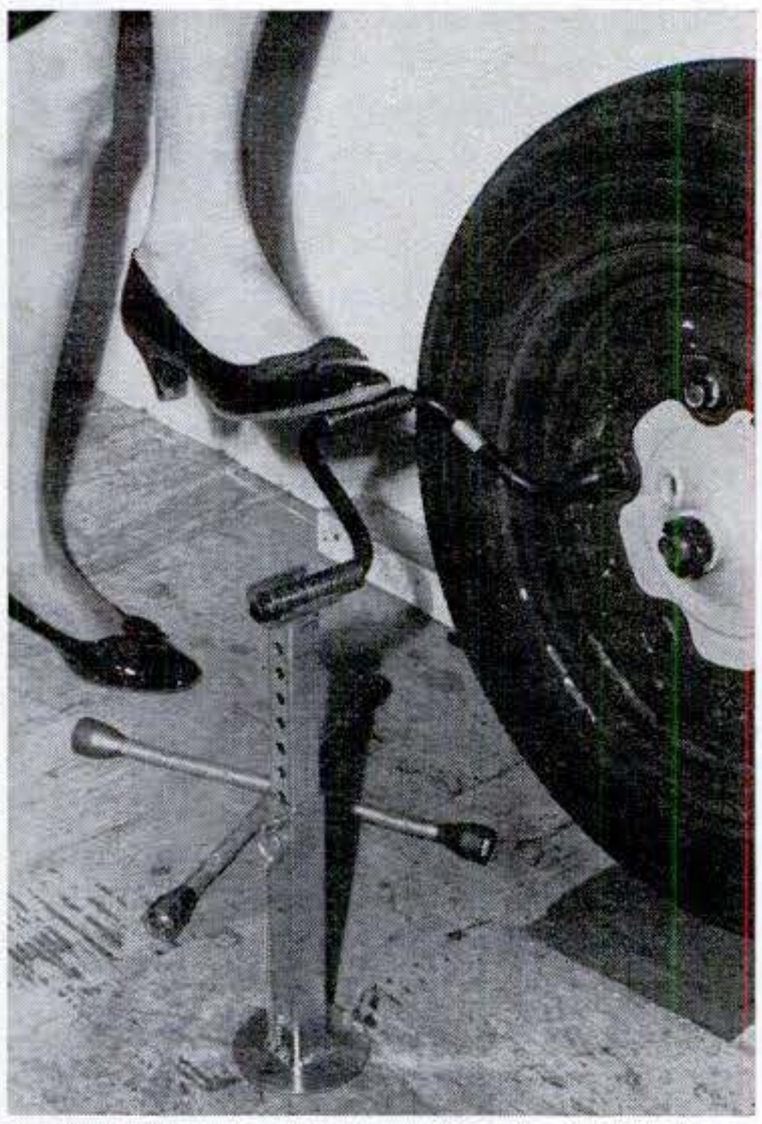


Spiral-wound exhaust pipes of stainless steel are light, flexible, long lasting. Special machines fabricate them from narrow strip into continuous helical-lock seam.

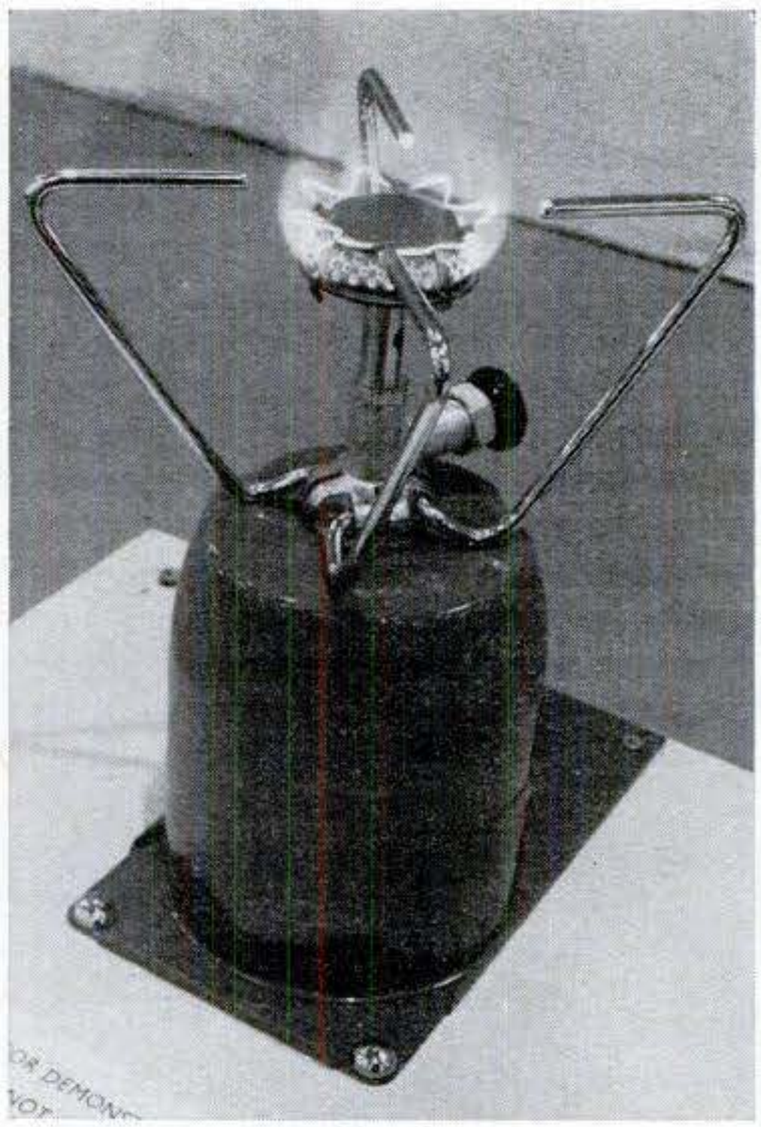
Telephone-answering tape recorder operates with no electrical connection to the line. It also lets you change your prerecorded answering message by calling your own number. If delayed by a lengthy meeting, you can rerecord a message to indicate a later return. Dial the number and whistle an individual preset code into the mike. This signal triggers a relay sequence so you can change the 20-second answering cassette. On normal incoming calls, a motor-driven arm lifts the hook.

INVENTORS' SHOW

Here are some ingenious inventions spotted at the huge exhibition in Brussels by PS's European Editor, David Scott



Adjustable column supports end of wheel-brace or cruciform wrench for no-strain loosening of tight nuts when changing a flat. It lets you use your feet for extra power and keeps your hands clean. Height is variable for loosening different studs.



Glowing wire on bottle-gas stove shows when it's burning—even in bright sun when it's otherwise invisible. Visual safety device is a metal disk with nickel-chrome wire. Disk rests on the burner like a lid. You can remove it easily for cleaning.

Umbrella cigarette dispenser has turret-like magazine in handle for five smokes. When you push a thumb slide, a cigarette tilts out through a door. A thin cable, passing over tiny pulleys, simultaneously ignites lighter at opposite side of the crook.

Copyrighted material

SPACE SUITS—from Pressurized

From high-flying aviators' earliest pressure suits stemmed moon gear for those record-breaking lunar jaunts that you watched on TV

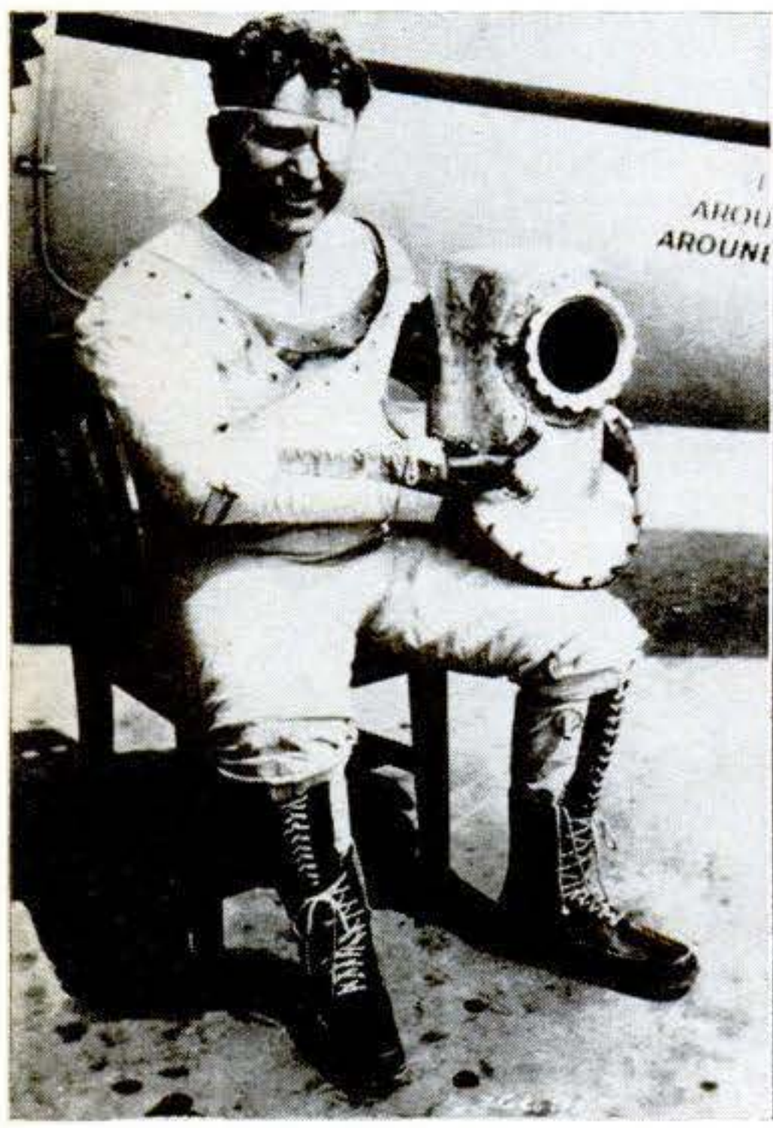
By DR. WERNHER von BRAUN
NASA Deputy Associate Administrator
PS Consulting Editor on Space

Two relaxed and exuberant spacemen set all-time moonwalking records last April. In three treks on successive days, Apollo 16 astronauts Young and Duke spent 20 hours and 14 minutes exploring the moon—nearly two hours longer than Apollo 15's previous mark. Their longest trip, of 7 hours 23 minutes, bettered Apollo 15's by 11 minutes.

Both Apollo 15 and 16 used improved new space suits and backpacks, carrying enough oxygen and cooling water for a nominal seven-hour sortie, against four hours in all preceding moon-landing missions. The suits' enhanced flexibility, plus lifts from lunar-roving vehicles, so eased the astronauts' exertions—and hence their oxygen and cooling needs—that left-over amounts of their carefully monitored "consumables" repeatedly gave them a bonus of precious minutes beyond the new seven-hour rating of their gear.

The evolution of space suits has come a long way since 1934 when Wiley Post, pioneer globe-circling pilot and discoverer of the jet stream, ordered a pressure suit for an attempt to break the world's altitude record of 47,532 feet.

Topped by a diver's helmet, his inflated suit of heavy rubberized fabric was designed to protect him from the near-vacuum of the upper atmosphere. Although Post set no officially recognized new mark, history does credit him with creating the world's first practical pressure suit, now a museum piece at the Smithsonian Institution.



Granddaddy of space suits (above), worn by Wiley Post in 1934, was made to his order by Goodrich for airplane altitude-record attempt. Diver's helmet topped it.

High-flying World War II airmen wore pressure suits as safeguard if bullets pierced pressurized cabins. This "Strato-Suit" was a Goodrich version of 1945.

By World War II, stratosphere flying had arrived, and Air Force and Navy airmen wore pressure suits to protect them when bullets punctured their pressurized cabins. An example was the illustrated "Strato-Suit," with a helmet of transparent plastic, developed in 1945 for the Air Service Technical Command. The stiff inflated suits, like Wiley Post's, offered little more mobility than a straitjacket.

America's first true space suit came into being for our Earth-orbiting Mercury astronauts of 1962-63. They needed a suit with enough mobility to handle controls and throw switches. Pressure suits were more flexible by then, and a Navy Mark IV suit was suitably modified. Along with a life-support system in the spacecraft, it would provide the wearer with a livable atmosphere if the cabin lost pressure—say, from a leak, or puncture by a meteoroid. Actually, no such emergency arose.

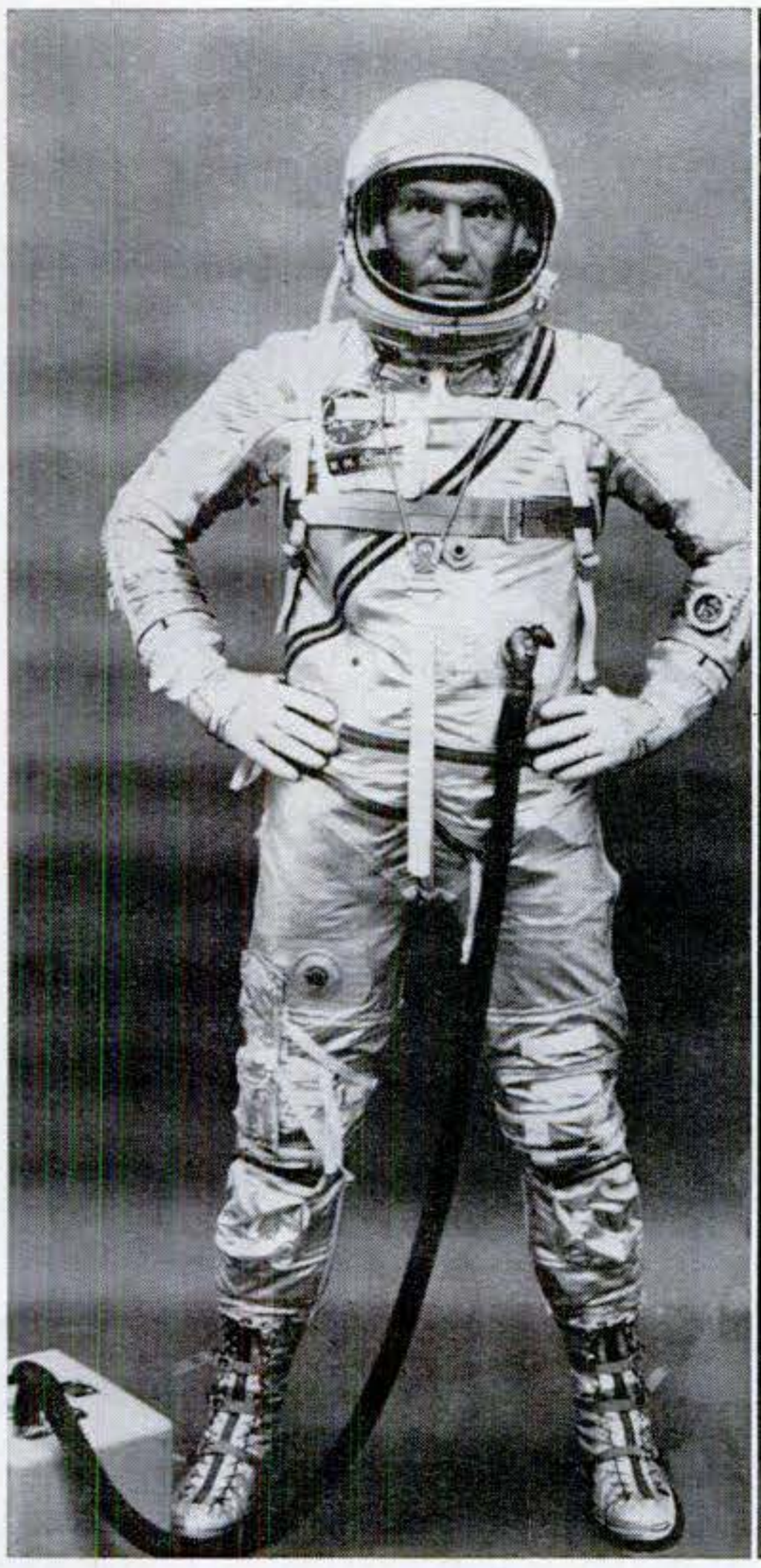
The why of space suits. Just what would happen to an unprotected human being in the zero-pressure vacuum of space? Human lungs collapse at a pressure not far below the minimum acceptable for a space suit, about 3½ pounds to the square inch. Even before pressure drops so low, accidental decompression of a cabin with an airlike atmosphere releases bubbles of nitrogen gas in the blood, causing an incapacitating or fatal attack of the dreaded decompression sickness that divers call "the bends."

[The peril of pressure loss was tragically demonstrated only last year when three Russian cosmonauts, after setting a 19-day endurance record in a Salyut space station, were found dead in a Soyuz spacecraft that returned them automatically to Earth. As in current U.S.S.R. and U.S. reentry procedure, they had not been wearing space suits—and a Soviet investigation showed they died suddenly from rapid loss of cabin pressure, apparently through a faultily sealed hatch.—*The Editors.*]

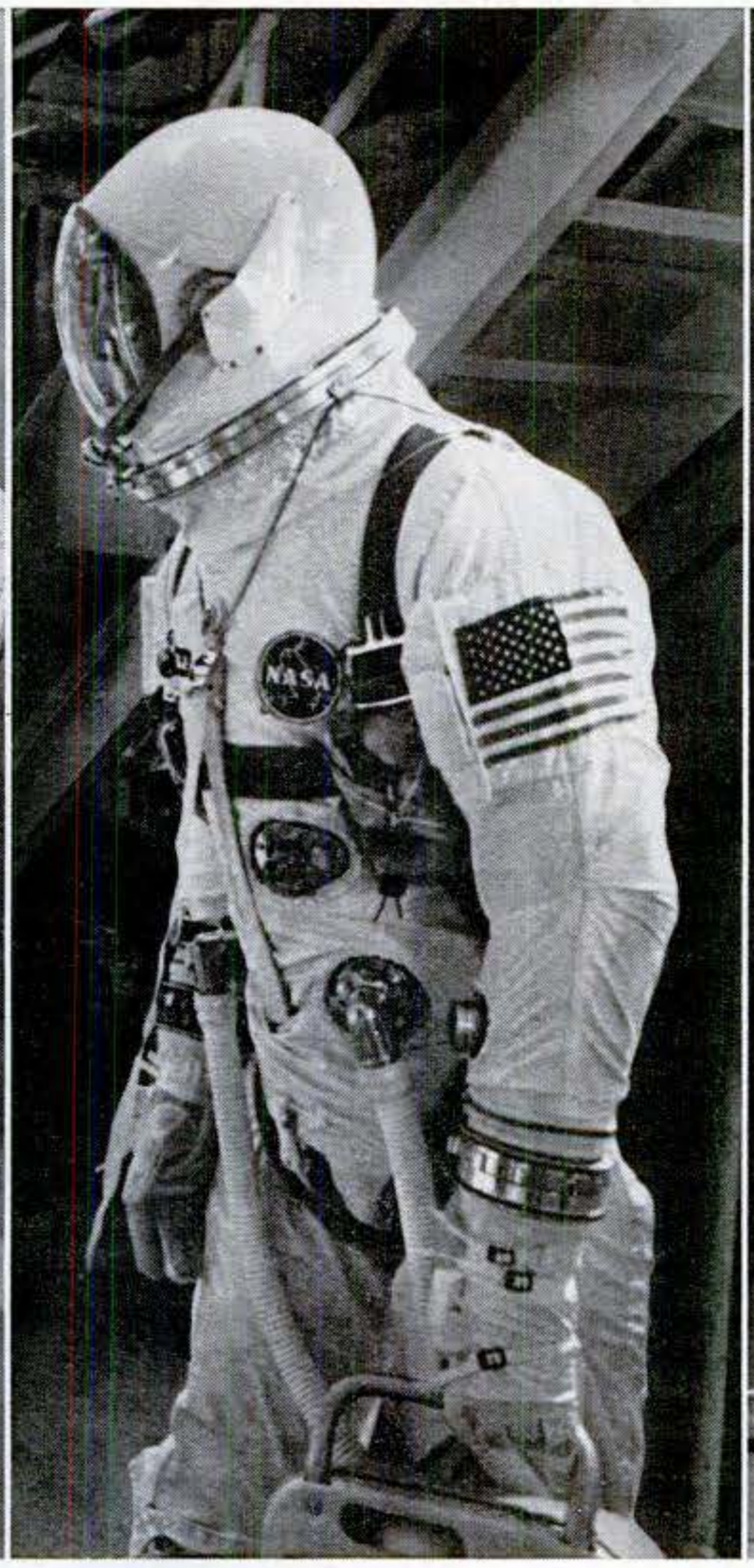
Suits for spacewalking. Gemini, the second phase of our manned space-flight program, had more ambitious objectives than Mercury. For one thing, NASA wanted to find whether an astronaut could emerge from the two-man spacecraft and perform useful work outside, protected only by his space suit. This "extravehicular activity" (EVA for short) advanced the role of the Gemini suit from a backup to a prime system.

Copyrighted material

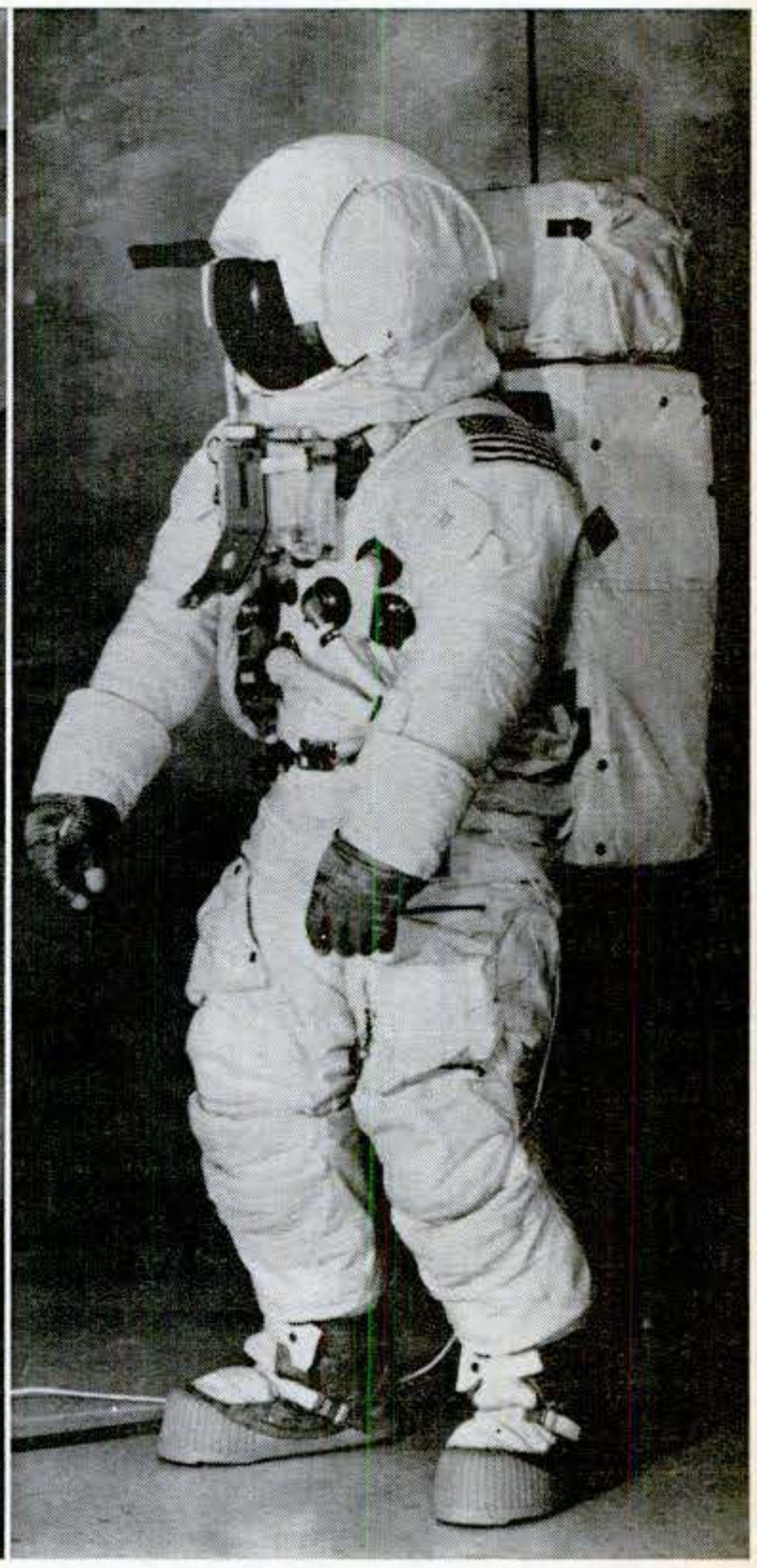
Prison to Mini-Spacecraft



America's first true space suit, for Mercury astronauts of 1962-63, was intended to save them if atmosphere of craft's cabin should escape. It never had to.



Gemini suit served first U.S. spacewalkers in flights of 1965-66. Oxygen from spacecraft reached astronaut working outside via trailing hose of umbilical line.



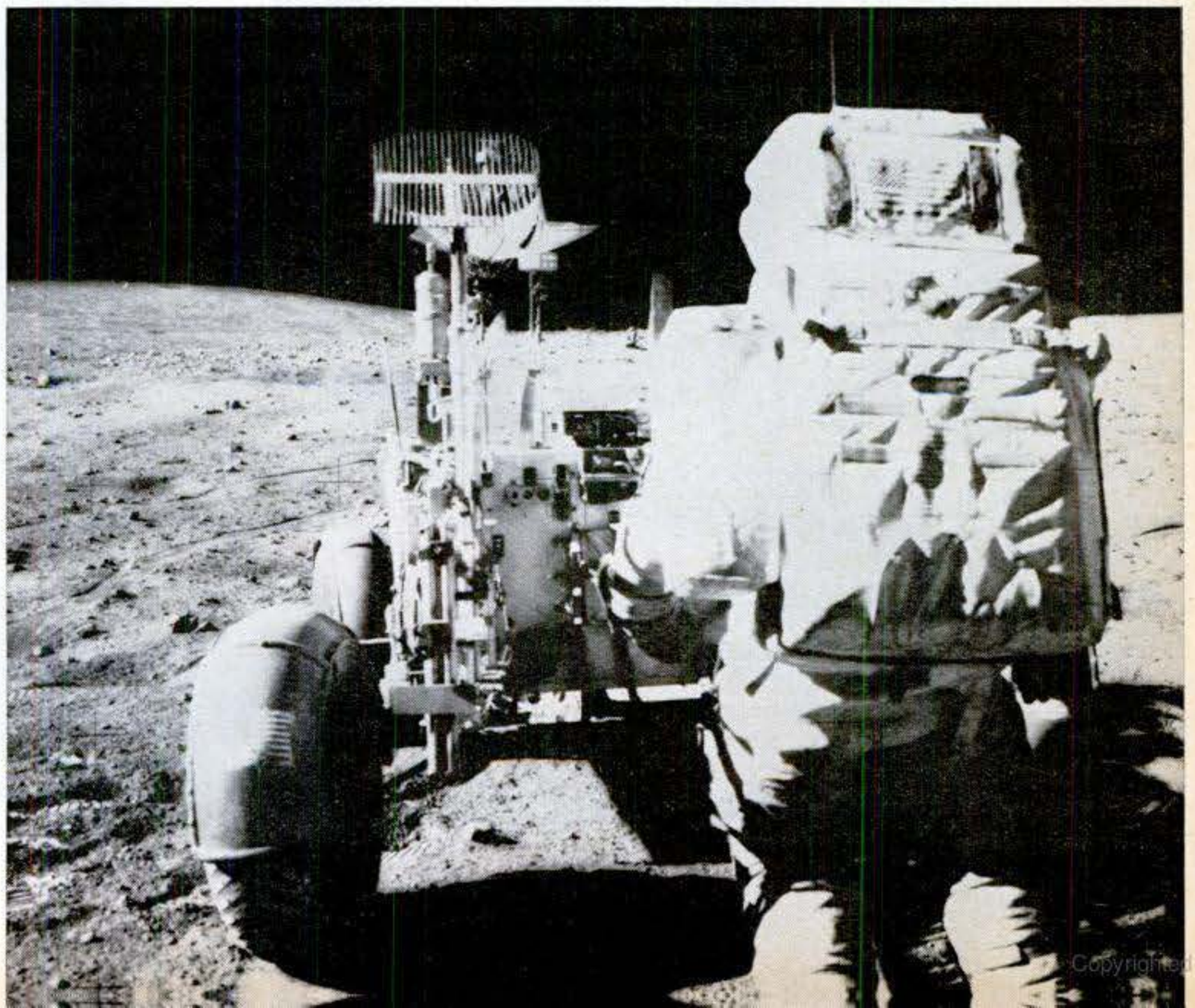
Apollo suit for moonwalking sets an astronaut free to roam over lunar surface. Backpack supplies oxygen and water-cooling to offset intense heat of blazing sun.

It demanded more mobility, better thermal protection, safety from micrometeoroids whizzing by in space. Since EVA required depressurizing the cabin to open the hatch, it needed an independent life-support system, which, however, could be in the cabin and supply oxygen to a spacewalker through the same umbilical line that carried the intercom cable.

Then came moonwalking. For NASA's lunar-landing program, space-suit requirements grew truly formidable:

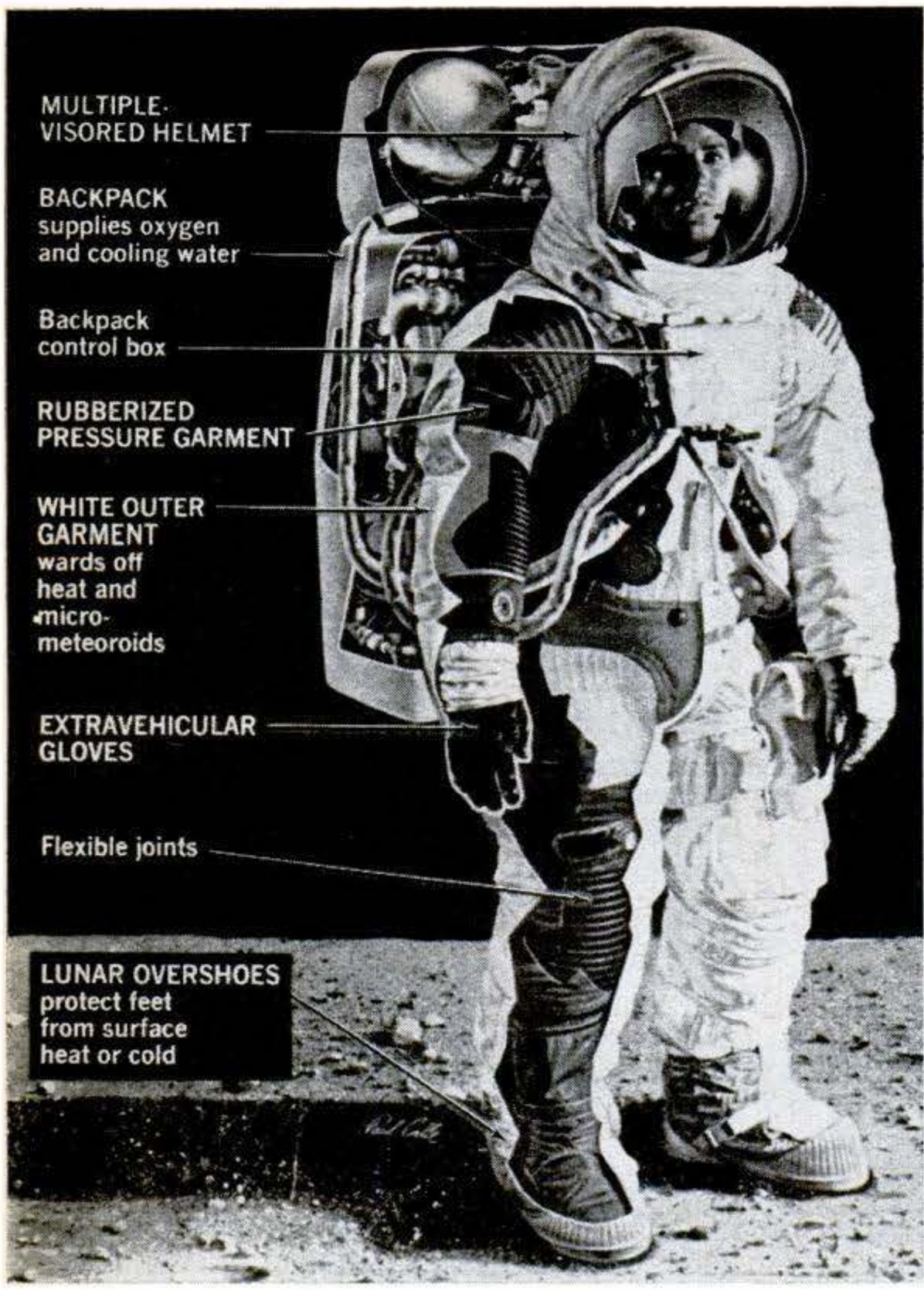
- Thermal protection and control had to cope with extremes from 250 degrees above zero Fahrenheit to 250 below, during lunar day and night; and with the varying metabolic heat output of a moonwalker at rest, or strenuously exerting himself to

Continued

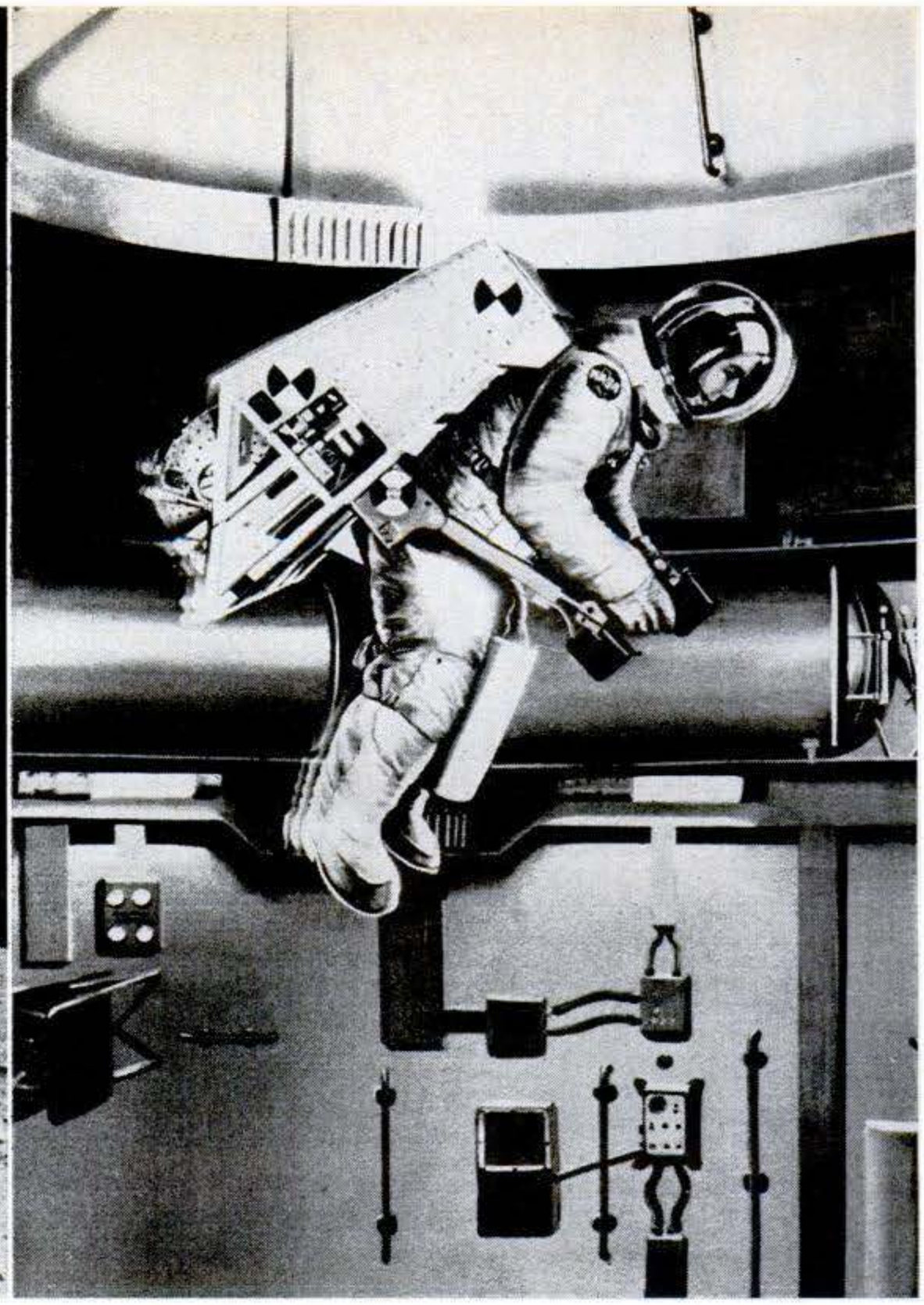


Apollo 16 commander John W. Young returns to moon car after one of stops on the mission's longest moonwalk, which set new record of 7 hours 33 minutes

Copyrighted material

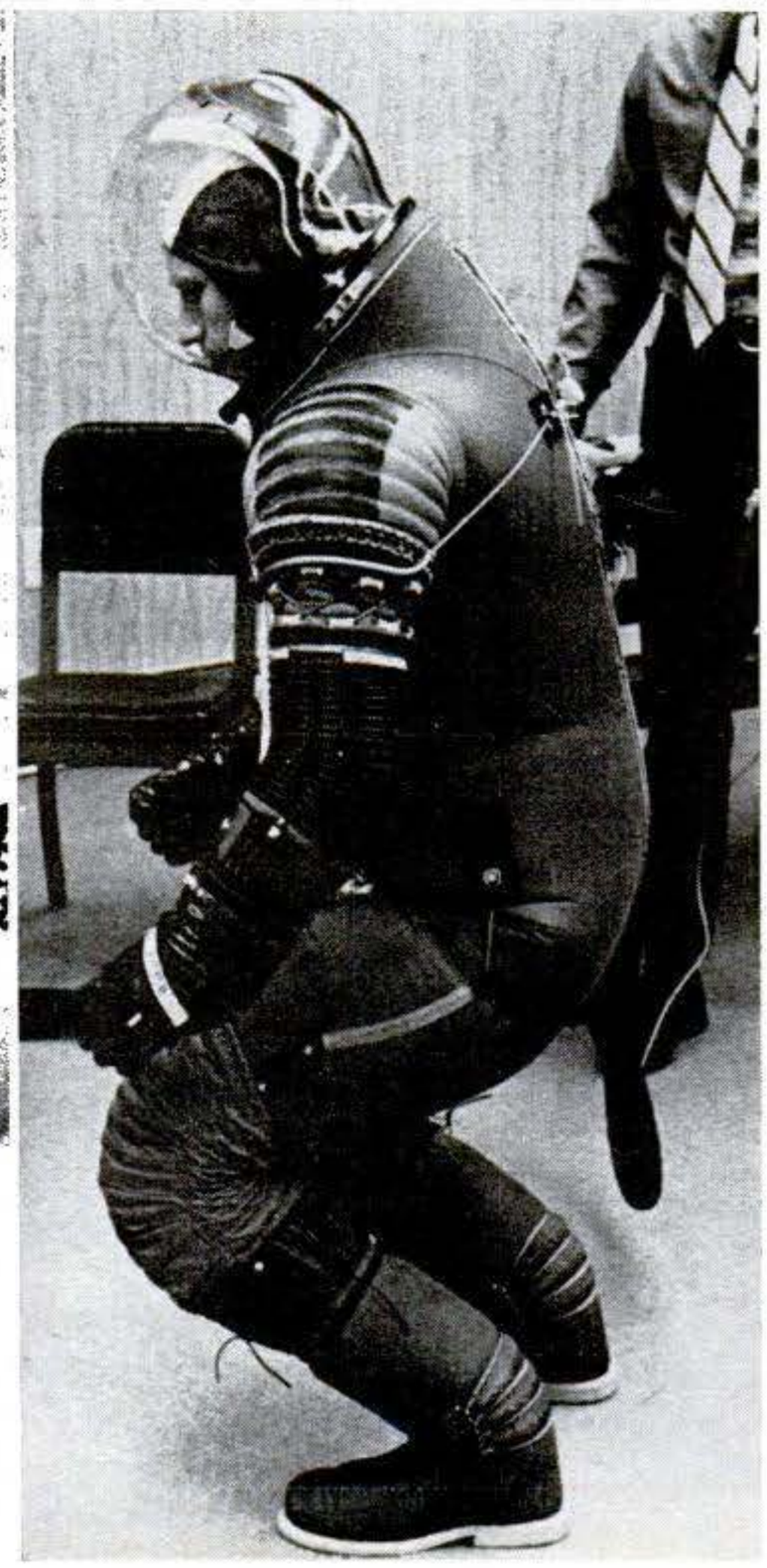


Cutaway view of latest-model Apollo suit and backpack reveals some of the principal components of the gear and their purposes.



Coming next: "outboard motors" for space suits. This backpack, due for trial inside Skylab as above, propels wearer with jets.

"Snoopy Hat," inside space-suit helmet, has twin mikes and earphones for two-way communication by radio. Wearer above: Neil Armstrong, first man on the moon.



Flexible new version of Apollo suit—shown at right without white outer garment, to reveal joints—enables moon explorer to bend or kneel to grasp specimens.

climb a lunar hill or wield a tool.

- The astronaut had to carry his whole life-support system on his back—plus an emergency system, in case the prime one failed.
- Radio communication was required between astronauts, and between the astronauts and Earth.
- Suits had to be rugged enough to withstand abrasion by lunar rocks—and, later, to tolerate a bumpy ride in a moon vehicle.
- Finally, astronauts had to be able to don and doff their gear in the confined quarters of the Lunar Module, for vitally needed sleep between arduous excursions outside.

The result was the Apollo suit and backpack—amounting to a spacecraft that, after being "boarded" by an astronaut, could walk upright.

A pressure garment, to which helmet and gloves are attached, forms the central element or "capsule" of the suit. Beneath it, an Apollo astronaut wears water-cooled underwear—a sort of open-mesh Long John, in which cooling water circulates through a network of plastic tubing. A waste-management system provides a built-in "John" during extended trips on the moon.

[Continued on page 121]

Copyrighted material

Dr. Land's "Impossible Dream"

New Polaroid pops out color prints in 1.3 seconds

By **ARTHUR FISHER**/*Group Editor, Science and Engineering*
ILLUSTRATION BY RAY PIOCH

"Photography will never be the same after today." The speaker was Dr. Edwin H. Land, and he was beaming at 3,000 wide-eyed and excited shareholders of the Polaroid Corporation.

With the air of a magician reaching for a very special rabbit, he pulled an object shaped something like a cassette player from his inside jacket pocket. One tug on a hump-like protrusion and the object unfolded into the unlikely shape you see here. Then he gave a demonstration that left the audience gasping. Two weeks later, he astounded the sophisticated members of the Society of Photographic Scientists and Engineers, meeting in San Francisco.

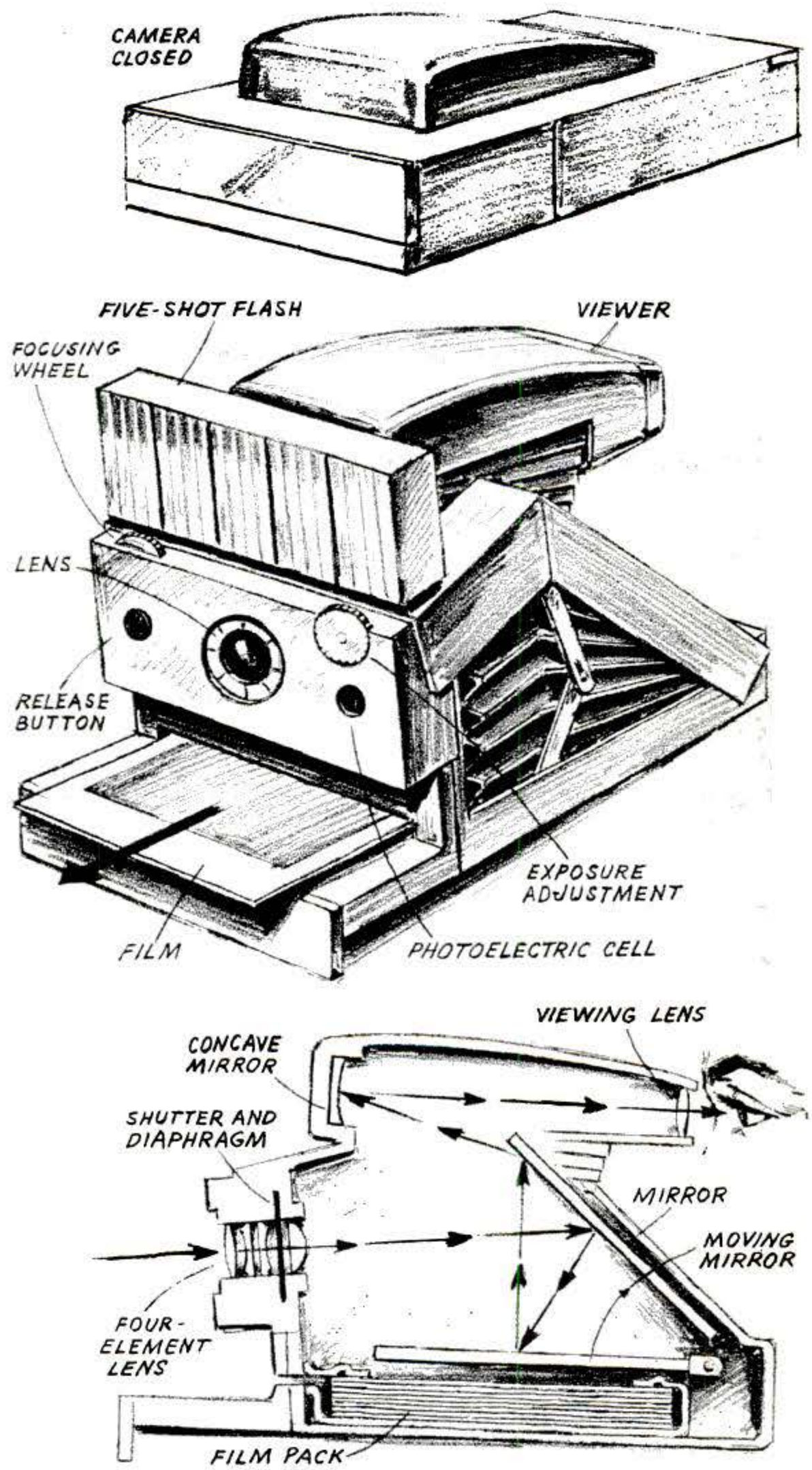
I attended both demonstrations. What I saw was a truly extraordinary, brand-new system of color photography. It consists of a revolutionary, no-mess film and a camera that does everything but ask the subject to say "cheese." Probably the most remarkable thing about the system is the uncanny way a print is produced.

Taking a picture. You aim, focus, and press a red button. There is a high-pitched whine as a motor runs, and almost immediately — in 1.3 seconds — a piece of film with a 3½-inch-square blue-green blank on it rolls out of the front of the camera. This print is clean and bone-dry. There is no messy chemical glop, and no paper to peel off. You don't have to do a thing except watch as an image slowly and mysteriously forms, gradually intensifying into a full-color picture — a matter of a few minutes. The process goes on inside the film, and is unaffected by full sunlight or even by dunking in a glass of water! The color quality? Far more saturated and natural than Polacolor. And if you want to, you can fire off a whole 10-pack of film in less than 20 seconds.

I know it sounds impossible, but this whole system is compounded of "impossible" features, including a unique lens, viewfinder, battery, flash, and a film that houses a virtual chemical darkroom. It's the culmination of a 15-year quest by Dr. Land for his dream camera.

How it works. Many details of this variety are still under wraps, with even a photo of the camera unobtainable. (These sketches rely on some very hasty observation.) But here's as much detail as I can supply now:

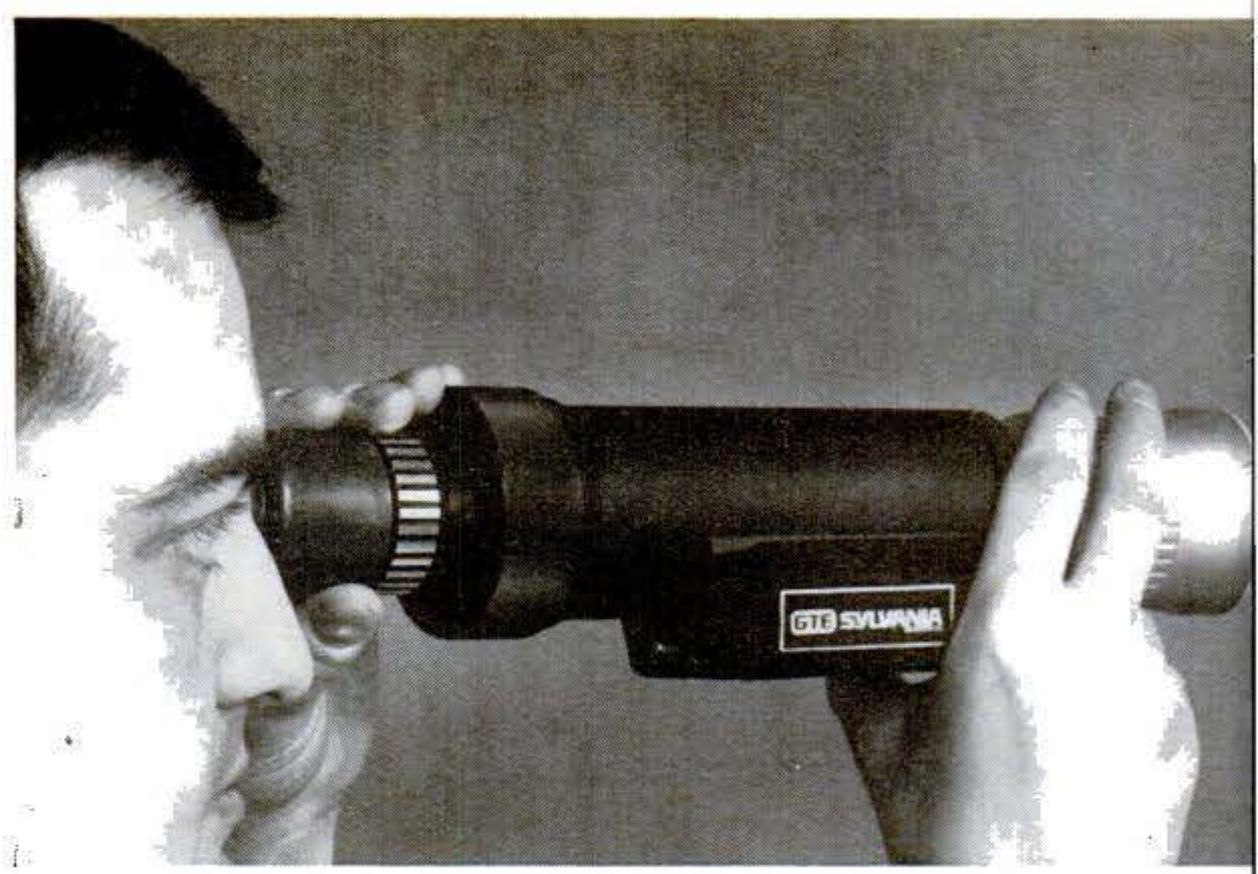
- The camera folds to a pocketable 1¼ by 4½ by 7 inches (approximately), weighs about 24 ounces, is made of plastic with a leather covering. Its brain is an electronic circuit with some 260 transistors.
- The motor drive that puts the camera through its paces is powered by a wafer-thin battery *inside the film pack*. You get a fresh one with each 10-pack of film.
- The lens is a four-element f/8 with a movable front element for focusing. Shutter is electronic.
- The viewfinder is a single-lens reflex type, but has no prism.
- The flash unit, developed by General Electric, has five lamps arrayed in a row. Nothing turns.
- The film has a speed of about 100, with resolution of about 40 lines. It is a multilayer sandwich with a plastic protective coating and an opaque support. A pod holding a tiny amount of liquid chemicals is buried between the layers. As the film moves through rollers, the liquid spreads over the negative and dries instantly. The film pack is loaded through the front; the motor automatically ejects the pack's lightproof cover when the front is closed.
- Price? Between $100 and $175, with film to cost the same per shot as Polacolor. When can you lay your hands on this impossible dream camera? Dr. Land hopes to make your Christmas a very, very merry one. PS



Nameless new Polaroid camera opens when you pull up on viewfinder housing. Viewing and focusing is of single-lens-reflex type—you see exactly what the picture will look like. Heavy prism is dispensed with by using unique optical system involving mirrors. When you press release button, bottom two-sided mirror flips up against sloping back mirror, reflects image down to film plane.

Copyrighted material

Fantastic New Scopes Let You See in the Dark



A new generation of night-vision scopes has been disclosed . . . and cameras with built-in light amplifiers are here

By **JOHN R. FREE** DRAWINGS BY RAY PIOCH

Pitch blackness. I was in a darkened room at Bendix's Sturbridge, Mass., Electro-Optics division. Just outside, behind an inch-thick wood-panel door, engineer Jim Abraham was standing in bright sunlight. A moment before, he had handed me a telescope-like image intensifier; a faint oscillator whine and a high-voltage crackle indicated that it was operating.

"What do you see?" Jim hollered.

Pointing the scope at his voice, a mind-boggling image flashed in the eyepiece. The door was now clearly visible —a pale-green rectangle. And a "shadow" on the door was obviously Abraham waving his arms. I was seeing him *through* the door! Why this incredible "Superman" effect? It occurred, Abraham explained, as light filtering through the door—far too faint for the human eye—was amplified 30,000 times by the three-pound intensifier.

A look at today's fast-changing image-intensifier technology reveals some fascinating new developments—and makes you distrust wooden doors. Three years ago the Army declassified the Starlight Scope, a first-generation intensifier developed in the sixties for Viet Nam night operations. First-generation scopes generally use three-staged intensifier tubes (diagram above); tubes that amplify light 30 times give you a gain of 27,000 (30 × 30 × 30).

Now, details on the military's second-generation intensifiers have been released. These scopes, using paper-thin microchannel plates (diagram, right), are one-third the size and weight of their predecessors.

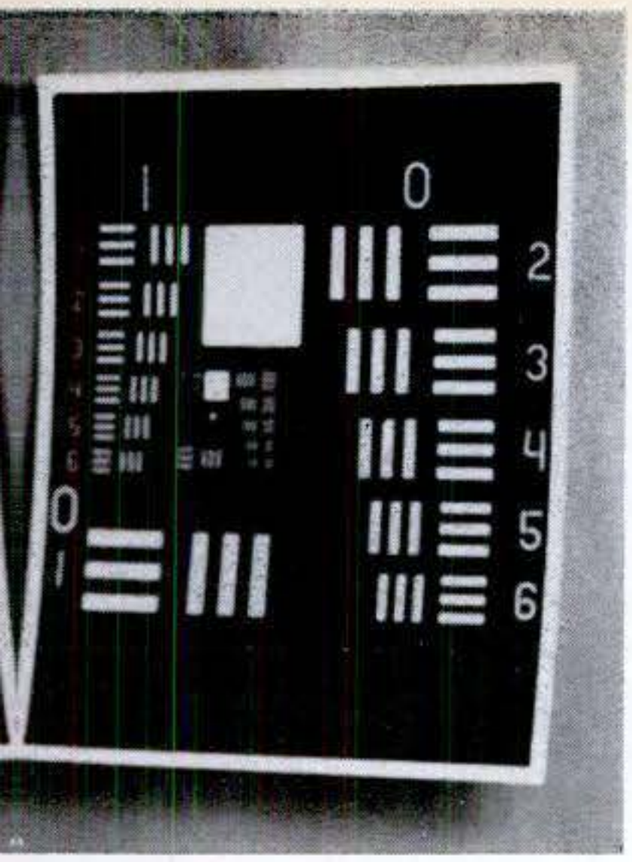
Cameras with built-in intensifiers. Special short-focus intensifier plates, described later, are used in ultracompact night-vision goggles for the military. Also, experimental cameras with built-in intensifiers can now make action-stopping photos in the dark at phenomenal film speeds: ASA equivalents in the millions are possible, although rarely practical.

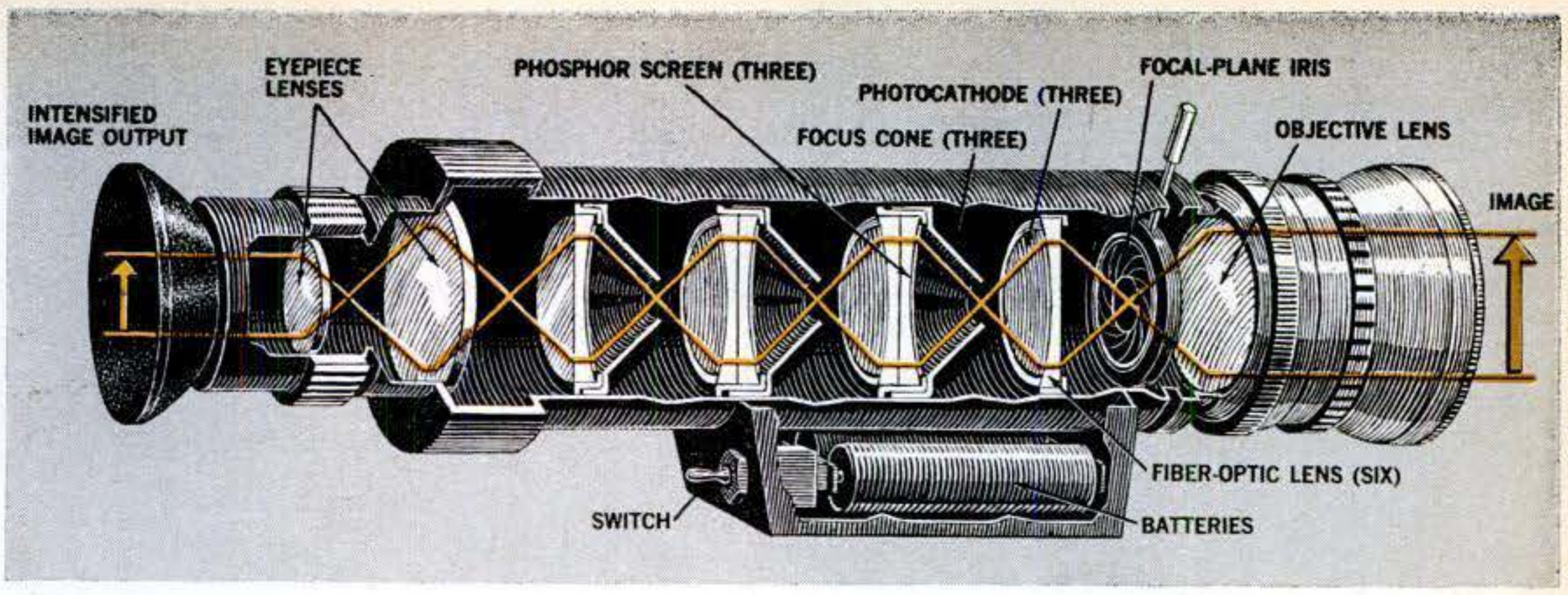
Intensifier scopes, of course, can also be mounted on still, motion-picture, and TV cameras. Recent night-fighting scenes from Belfast, N. Ireland, shown on network television, were obtained with image intensifiers.

Since 1969, nonmilitary versions of Starlight Scopes have been widely adopted by law-enforcement and industrial-security agencies. Second-generation scopes will

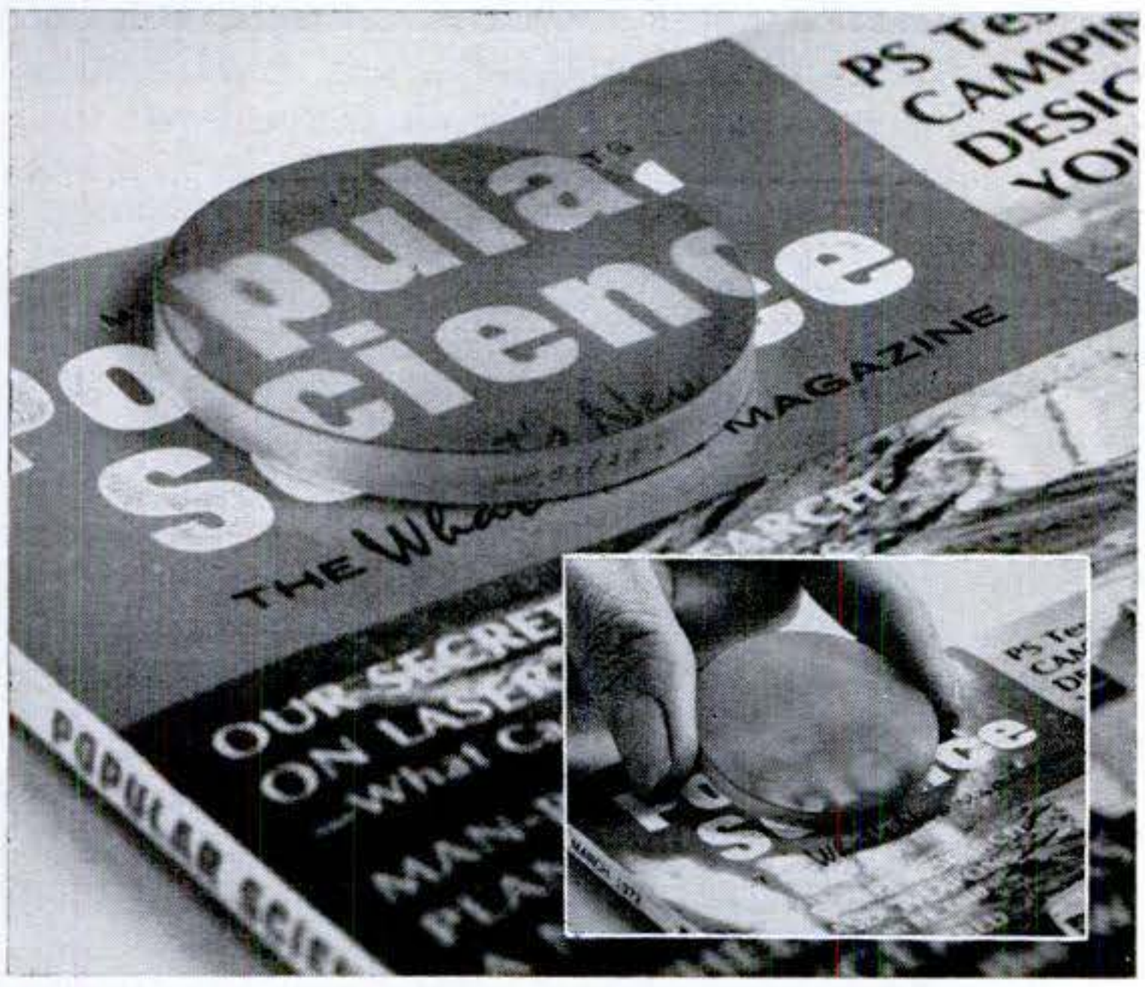
Continued

Copyrighted material

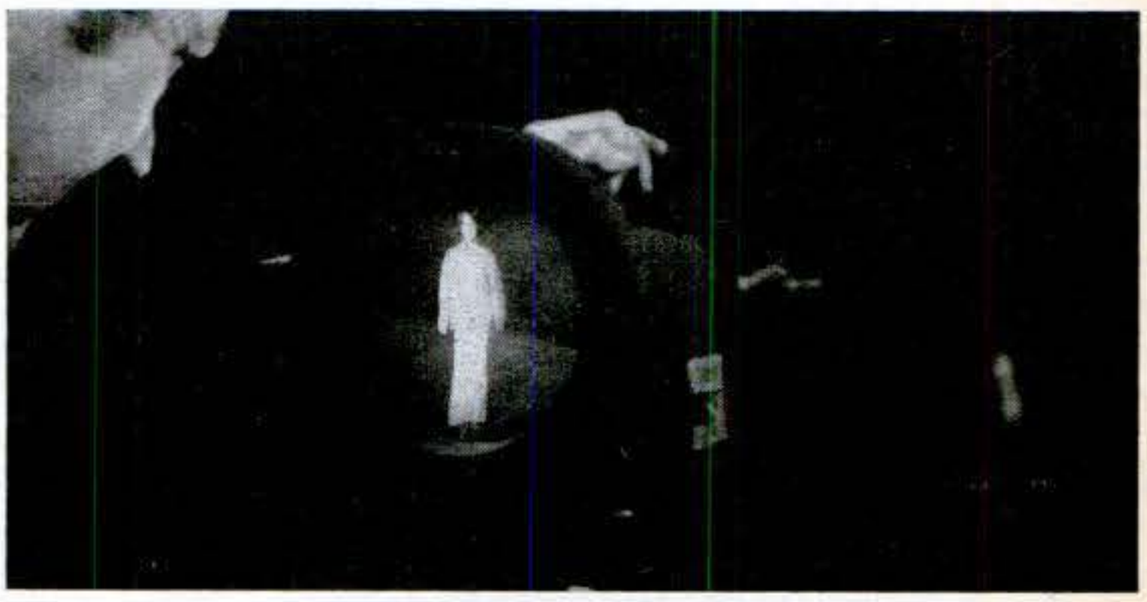




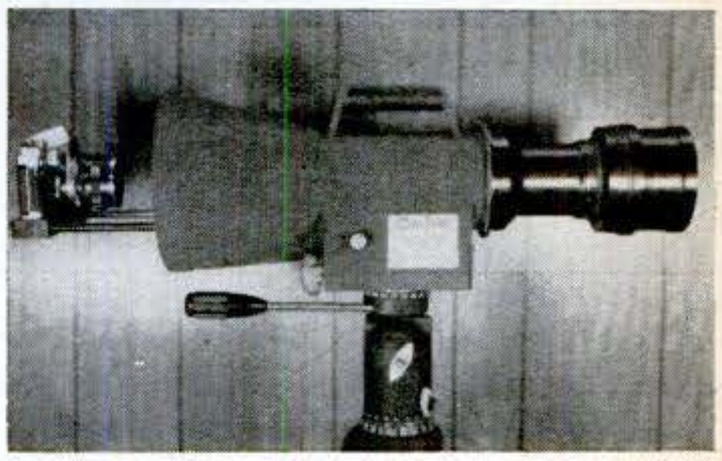
Faint image is focused on fiber-optic lens in first stage of a three-tube intensifier scope. Light causes photocathode surface on lens to emit electrons, which are accelerated by 15,000 volts, and focused by cone on a phosphor-coated disk. The glowing, intensified phosphor image is further amplified by next two stages. Wall chart shows line pairs per mm scopes can resolve as light intensity varies.



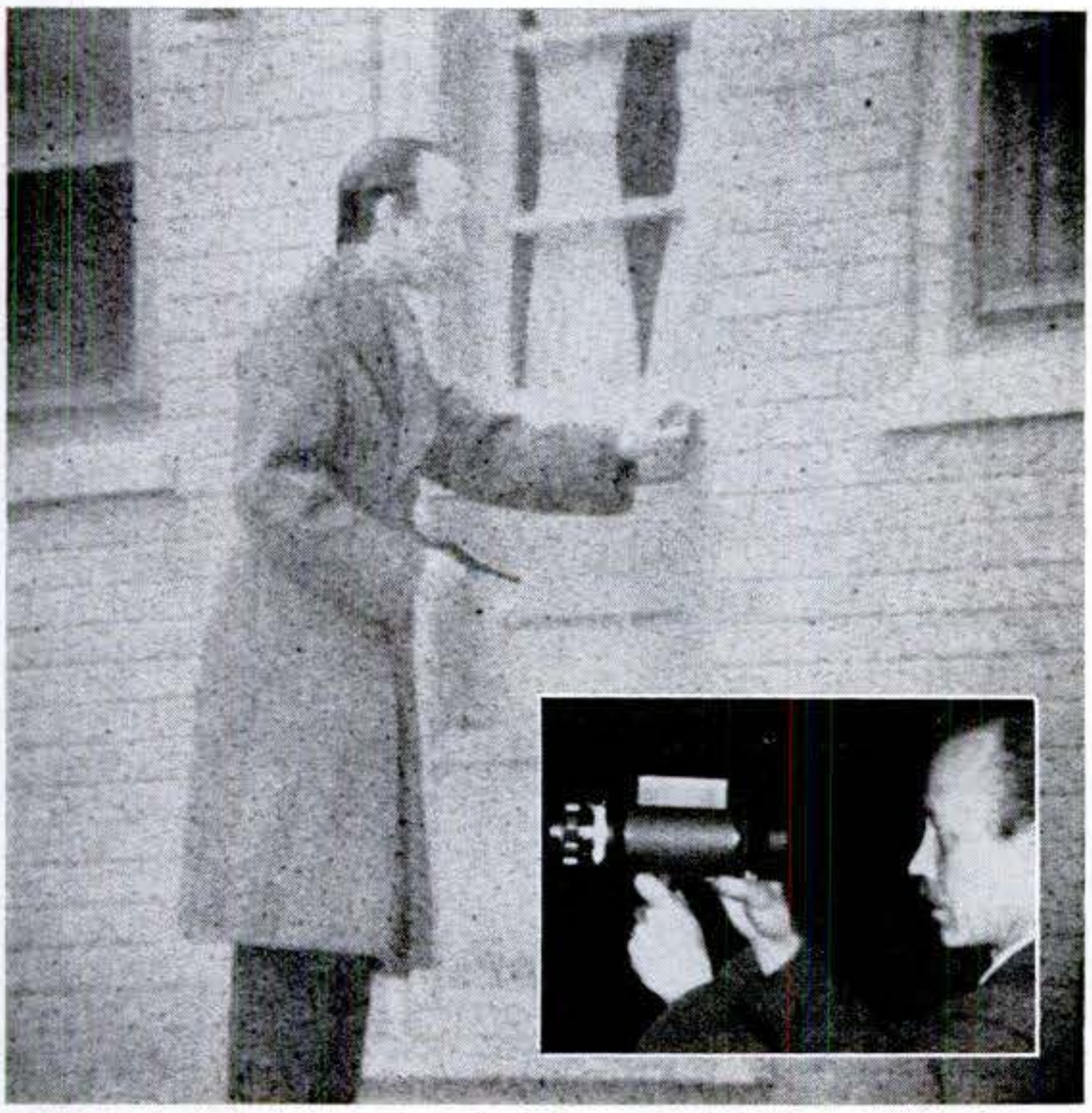
Fiber-optic disk transfers image on one surface to opposite face. Disk appears frosted (inset) unless the image contacts fibers.



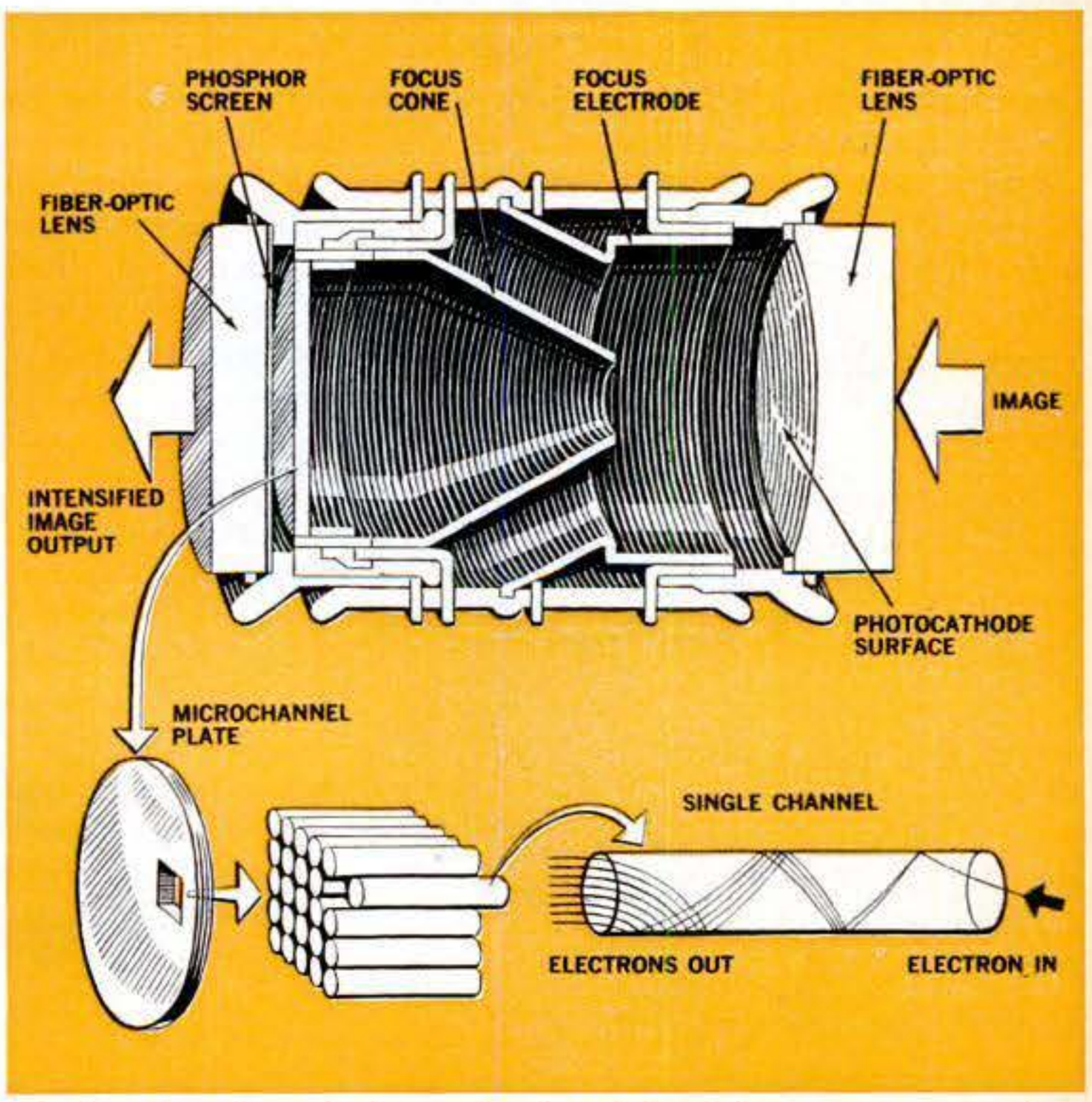
On dark street, Owl Eye scope pulls image from gloom, displaying it on five-inch phosphor tube, one of three intensifiers.



To capture subject in the dark on film, Owl Eye with telephoto lens has camera mount.

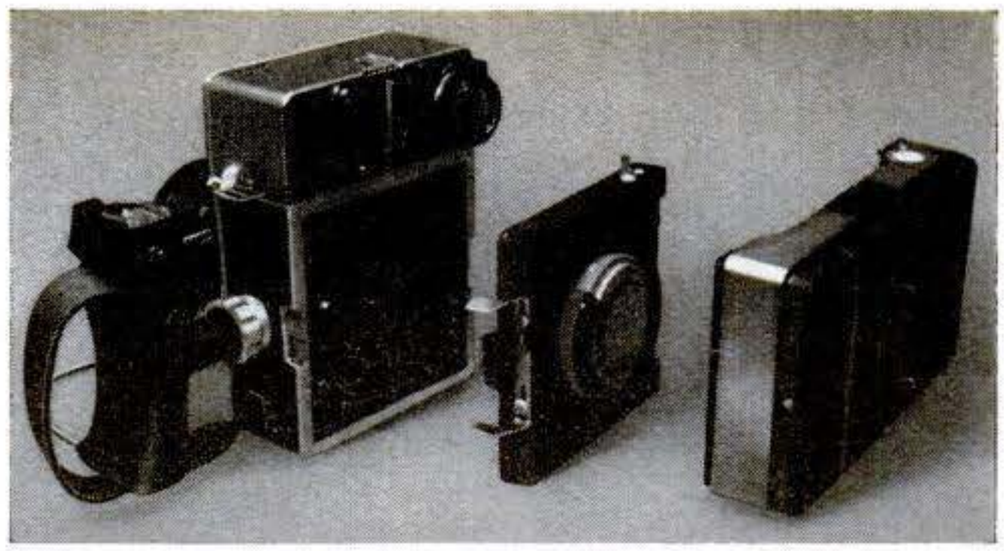


"Prowler" is photographed in half-moon lighting at 75 feet with Zenith's compact new Uniscope, which uses a microchannel plate (diagram, right). It's shown with 85mm lens used for shot.



Single microchannel-plate tube does job of three-stage intensifier. High voltage across plate can multiply single electron from photocathode into 10,000 electrons striking the phosphor screen.

Copyrighted material



Wafer-thin Bendix intensifier installed between camera body and Polaroid 3000 film made photo above. Exposure: 1/8 second at f/2.8 using penlight bounced off ceiling.

Night-vision military goggles made by ITT use special microchannel-plate tubes. Distortionless 60-degree field and 1X magnification aid hands-free night operations.

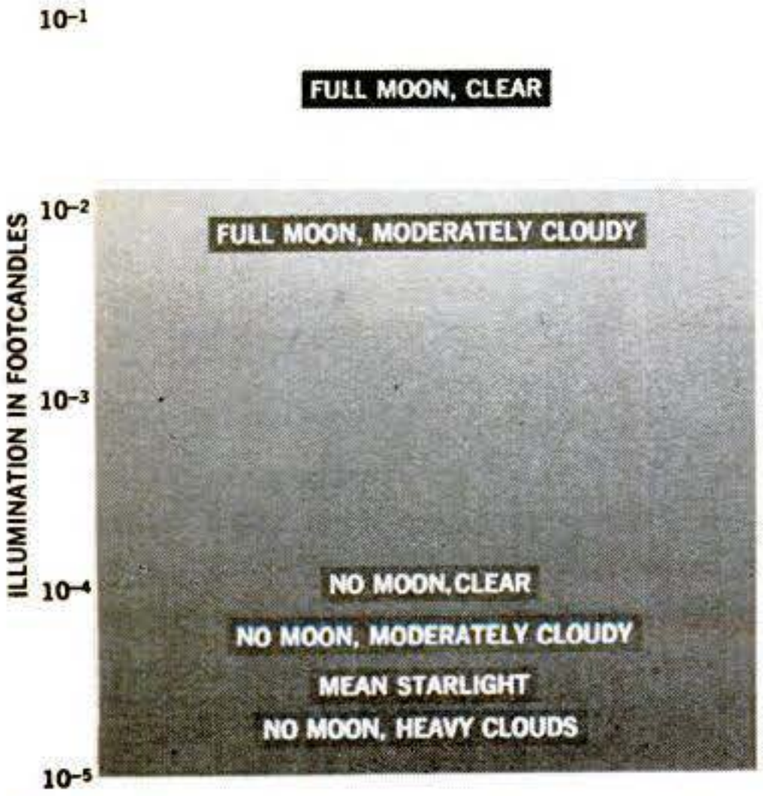
soon join the war on crime: Zenith has just introduced the compact Uniscope pictured. Police are filing an impressive list of captures using image intensifiers.

In one early application of the Owl Eye scope pictured, for example, New York City police stopped a five-member gang who were "ripping off" jewelry factories in the city's diamond district. Entering a building, the thieves cut electrical power to lights and elevators. Police, responding to safe alarms, would arrive just as the gang escaped with ropes and ladders over darkened rooftops. One night, moving through the dark with an Owl Eye, police surprised the gang; one member, who thought he was descending a rope under cover of darkness, was captured.

See-in-the-dark scopes are also turning search-and-rescue attempts into more successful 24-hour operations. In mountains near San Gabriel, Calif., a missing boy was spotted with a scope from a helicopter. The sheriff's rescue party, 100 yards away, had missed him in the dark.

Where mobility isn't needed, another type of image intensifier is often used: low-light-level TV cameras [PS, Nov. '70]. Several types of light-sensitive camera tubes are used; an electron beam scans the tube's target and converts the image into an electronic signal.

MIDNIGHT SKY ILLUMINATION



On darkest nights, scopes show fewer details since less light is reflected from scene.

Making fiber optics. Before detailing how direct-vision (non-TV) intensifiers work, let's look at one of the key components: fiber-optic disks. Physicist Larry Owen guided me through Bendix's facilities, where intensifier components are made.

We began in a ground-floor room stacked with bags of sand-like material and chemicals. Small furnaces melt these ingredients into glass with various optical properties. Next door, dozens of yard-long, two-inch-diameter glass rods—looking like icicles—were cooling.

We next saw the rods three stories up, on the top floor. Here a hollow glass tube with low refractive index is slipped over the rods. Heated at one point, the rod is slowly pulled by continuous belts, through holes in the floors, to the ground level. There, stretched to pencil thickness, four-foot lengths are snipped off.

Microscopic fibers. At this point, light entering one end of a rod at a relatively shallow angle will reflect along the inside wall of the rod, emerging at the other end. Next, the pencil-thick rods are bundled together with opaque rods intermixed between them.

The whole bundle is then pulled to pencil diameter. Individual rods become clad with the melted opaque glass. As a result, light entering the rods at a sharp angle will not scatter through the first sheath into adjacent rods. This cutting, bundling, and stretching process continues until each original rod has been reduced to a microscopic, two-to-10-micron fiber (about one-eighth the thickness of a human hair). Densities of over three million fibers per square inch are typical. Finally, pencil-lead-diameter rods are bundled, fused together, and sliced into disks.

Handing me such a disk, Owen explained: "Fiber optics was developed to transfer an image plane. It can't be used in place of a lens—it can't focus an image." You can demonstrate this image-transfer property by placing a disk (available from Edmund Scientific Co. and elsewhere) on a printed surface (see photo).

First-generation tubes. In a three-stage intensifier scope, the image plane is focused on a fiber-optic disk with a lens. The other surface of the disk, inside the first intensifier tube, is a concave photocathode. When the image is transferred to this surface, electrons are emitted. Most important, disks maintain a tube vacuum.

Electrons released by the photocathode are accelerated by high voltage. The light image, now an electron image, is focused by voltage applied to a metal cone. The concave photocathode surface, matched to the focusing cone, insures that electrons travel the same distance.

Electrons plow through a thin aluminum film covering a concave phosphor surface on the rear fiber-optic disk. The glowing phosphor transforms the electron image back into a light image. The aluminum prevents light from the phosphor from traveling back up the tube to the photocathode. The output image is 30 to 50 times brighter than the input because of the high-voltage boost given to the electrons. This light image is then amplified by the next two stages.

Tiny oscillator and voltage-multiplifer circuits boost a few battery volts to 45 kv (15 kv per tube). Automatic-brightness-control circuits regulate current flow so the eyepiece view remains at a constant brightness level. Scene *details*, however, fade as available light is decreased; turning your TV-set contrast control down gives a similar effect.

Second-generation tubes. Some scopes have a mechanical iris, enabling you to block out interfering lights. A bright light—a flare, car headlamps—can cause image bloom

[Continued on page 117]

Copyrighted material

Mod 24: Good-bye to 16-Inch O.C.?

With fewer wall studs and floor joists, your next home could cost you less

By DOUG GARR

This test house built with both 24-inch wall and floor framing held up fine, cost less.

Scouting locations for a new home? If you're thinking about a ranch or two-story job, you may want to check out Mod 24—an old idea now getting a new push for wood-frame house building. Simply, Mod 24 means spacing wall studs and floor joists 24 inches o.c. (on center) instead of the traditional 16-inch o.c. spacing.

Recently, the American Plywood Assn. and Western Wood Products Assn. collaborated with the National Assn. of Home Builders to see how well 24-inch spacing works. They built two identical 1,600-square-foot, two-story houses in Pleasanton, Calif. The only difference between them was the stud spacing; one used 24-inch, the other 16-inch.

Results? Labor and materials on the 24-inch model were substantially cheaper in every respect except in the cost of the plywood sheathing (siding and subfloors). With wider spacing, to meet strength requirements you need a heavier covering to make up for fewer studs. Labor saved with Mod 24 was 19 man-hours—almost a half-day's work for a five-man crew. The overall savings were $218.45, or about 6½ percent. Naturally, costs and savings vary according to the area.

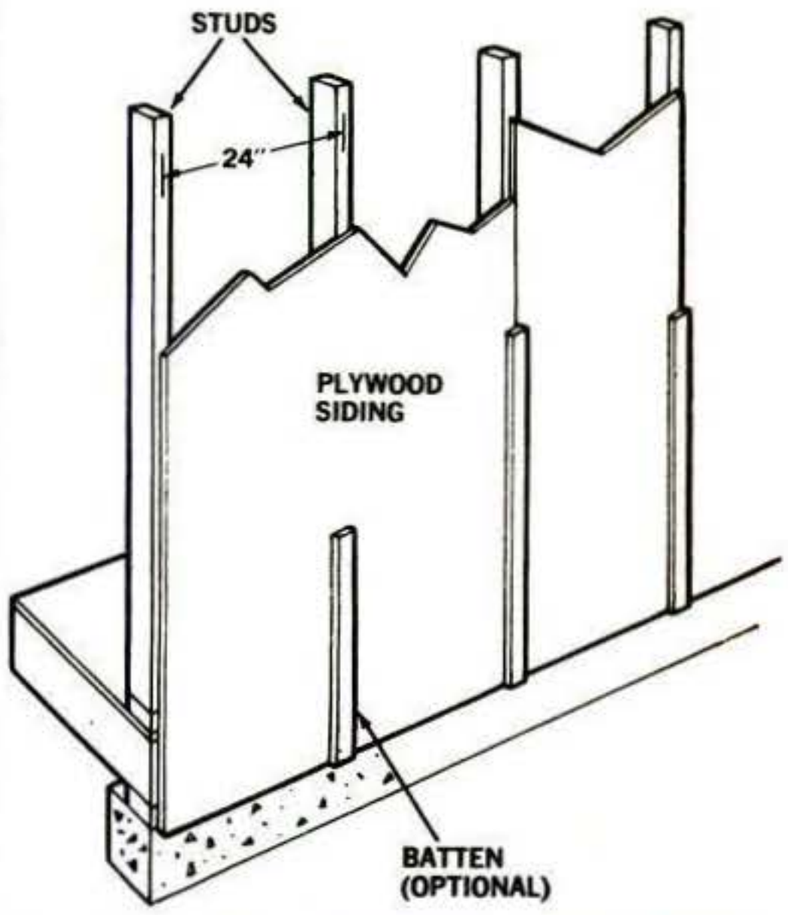
Did the wider spacing hold up? Mel Blais of Western Wood Products reports, "The new system has a fully adequate strength reserve. In actual tests, it was surprising how much it exceeded minimums before breaking."

The Federal Housing Authority has approved 24-inch spacing, and the Uniform Building Code, which governs about 1,000 locales in the West and North Central states, has also accepted the system. If you decide on a 24-inch o.c., check local building codes before you see your contractor.

Does Mod 24 really mean the end of 16-inch spacing? A spokesman for the National Assn. of Home Builders says, "There's little need now for 16-inch spacing, and pretty soon it will be phased out." PS

Plywood was glued and nailed onto two-by-10 joists spaced 24 inches o.c. Spacing of 1/16 inch between edge and end joints allowed for expansion of plywood.

Wider-spaced wall studs saved time for work crew. Drywall and electrical installation also went faster with Mod 24.



In single-wall construction, one plywood layer is sheathing and siding. Studs up to 10 feet can be used on one-story jobs.

Copyrighted material

What's New

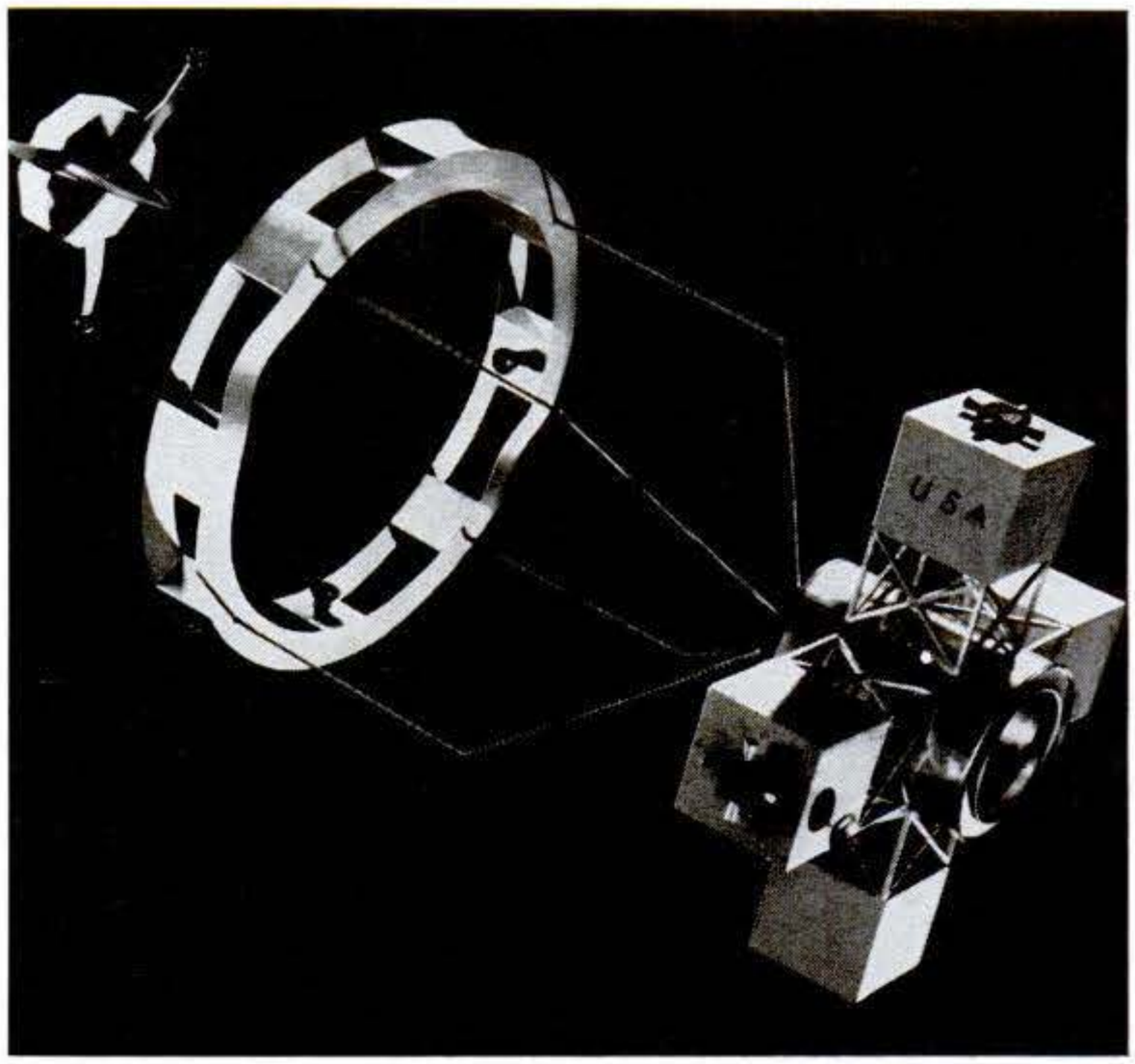
A PICTURE ROUNDUP OF NEW PRODUCTS AND DEVELOPMENTS

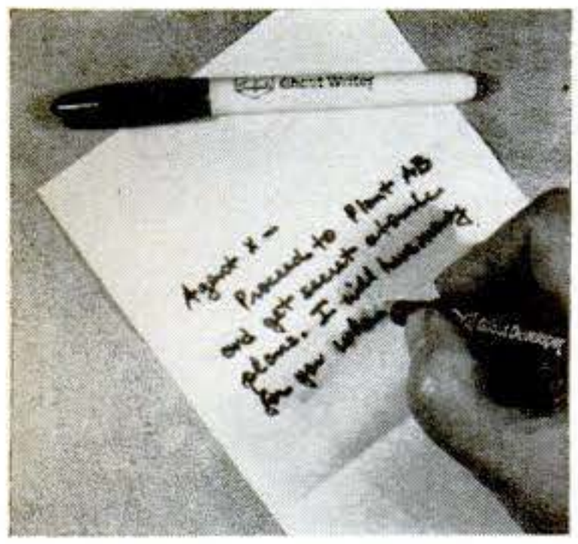
Heat-seeing camera

The 10-pound Pinto Primer puts it all in one small box: a scanning infrared TV camera that sees anything that gives off heat. It'll be used by engineers to spot dangerous heat buildups in tires or mechanical components, or by surveillance men to see intruders in the dark.

Fly-away ejection seat takes to the air

SAVER, a new ejection system that permits a pilot to eject from his aircraft and then fly away—up to 50 nautical miles—is shown above in its first test flight. Rotor, jet engine, and controls unfold upon activation of the system to turn the seat into an autogyro that can navigate automatically. In the case of an unconscious pilot, the seat, after ejection, would follow a radio beacon to a safe landing area. Made by Kaman Aerospace Corp., SAVER (for Stowable Aircrew Vehicle Escape Rotoseat) is one of several parallel concepts under study by the Navy and Air Force.





Spy kit

Spies, lovers, and kids who wish to pen secret messages can now do it the easy way: with the Ghost Writer kit. The sender writes in invisible ink with the Ghost Writer; the recipient runs Ghost Developer over the message. Both are 98 cents in stores. It's made by Sanford Corp.

Electric two-seater

The British are taking a hard look at pollution-free electric cars, too. This British Leyland Corp. two-seater, styled by Michelotti of Italy, is powered by 24 lead-acid batteries, with two 3.9-hp motors driving the front wheels. Max speed is 33 mph, range 40 miles. It recharges overnight.

Space mitt

What'll we do about the 2,600 Earth-orbiting objects we've rocketed up there? Dr. Marshall Kaplan of Penn State has designed the world's first "space mitt" to retrieve them. It will not only clear low-orbit traffic lanes, but make possible repair and re-insertion into orbit of crippled satellites.

Copyrighted material

No-hands phone

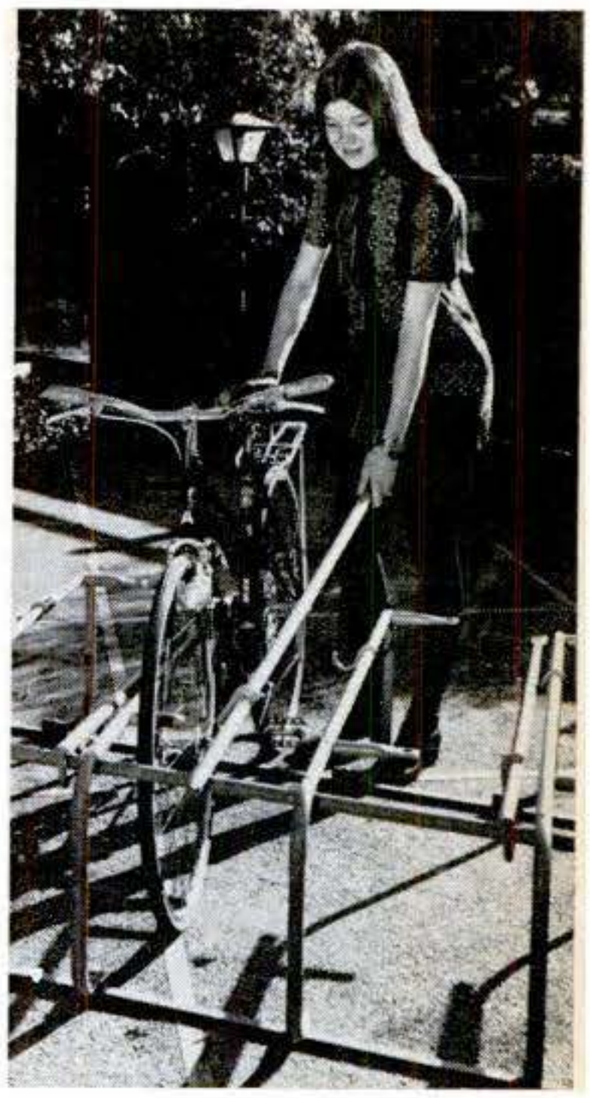
Bell Laboratories is trying out this no-hands vandal-resistant coin phone in six cities. There's no receiver. An "on" button and coin activate a microphone and speaker. An "off" button or (if you forget to push the button) automatic timer disconnects the call when you leave the booth.

Electronic reader

This blind girl is reading ordinary printed matter. Her right hand moves a pocket-knife-size TV scanner over the type; the fingertips of her left hand are on a box that converts the scanner's signals to vibrations. The new device is called an Optacon (optical-to-tactile converter).

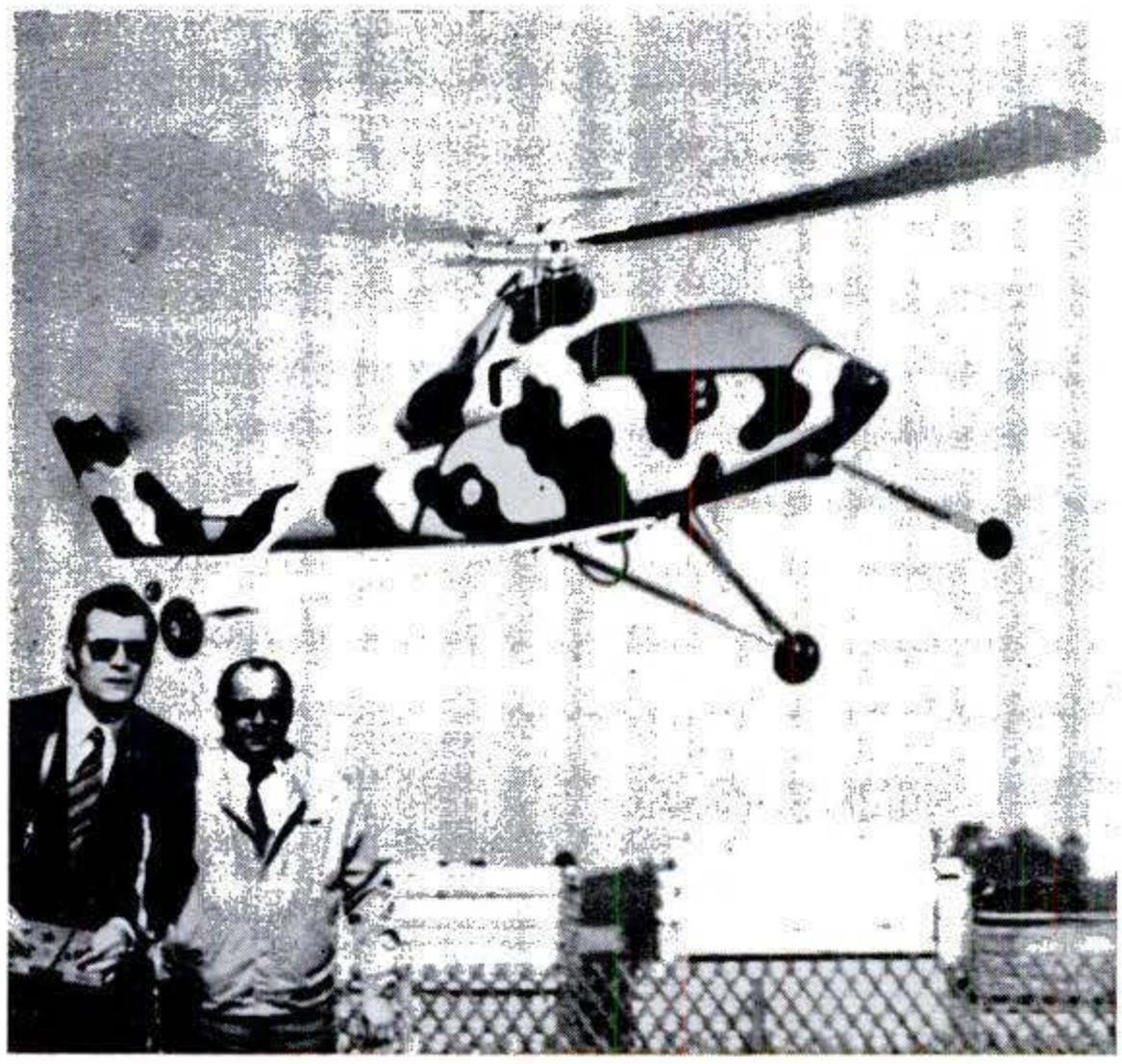
Bag carrier

It's a small L-shaped tubular steel frame strapped to one of your bags. No porter in sight? Open it, and the Travel Kart becomes a two-wheel dolly able to carry up to 200 pounds. It's $28.95 from JLM Products, 6805 Boysenberry Way, Colorado Springs, Colo. 80907.



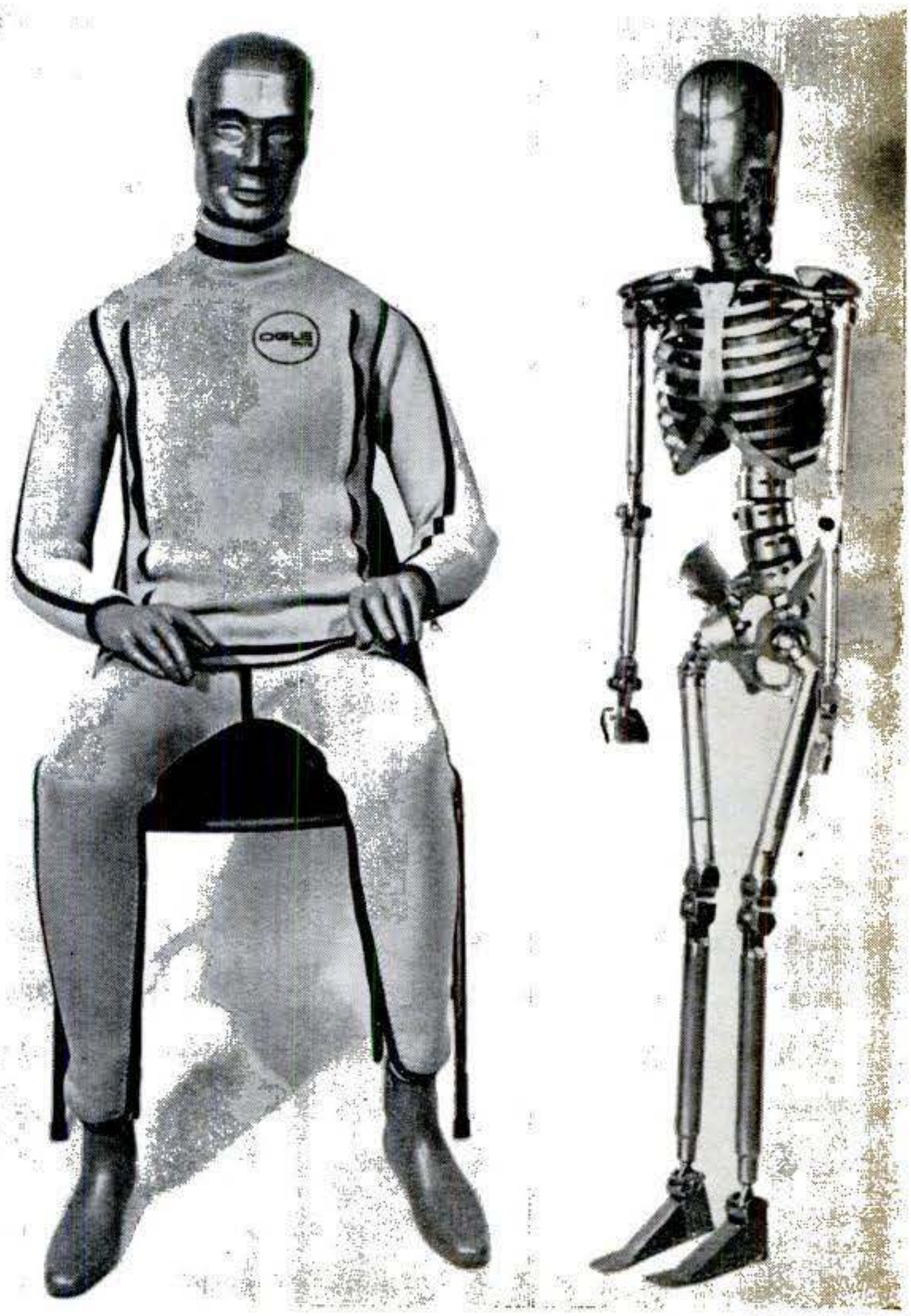
Locking rack

No chains are needed with this five-bike rack—horizontal bars lock both wheels and frame securely in a few seconds. It's made for schools, shopping malls, wherever cyclists may wander. Bike-Safe 305 sells for $99. Maker: Bike Safe Co., Box 976, Los Altos, Calif. 94022.



Little Huey

Forward or backward, sideways, up or down, even hovering, this scale Cobra copter performs just like the big Bell Huey Cobra it's modeled after. You fly it with a four-channel radio control. The Cobra kit, distributed in the U.S. by Aristo-Craft, is $349.95 without engine or radio.

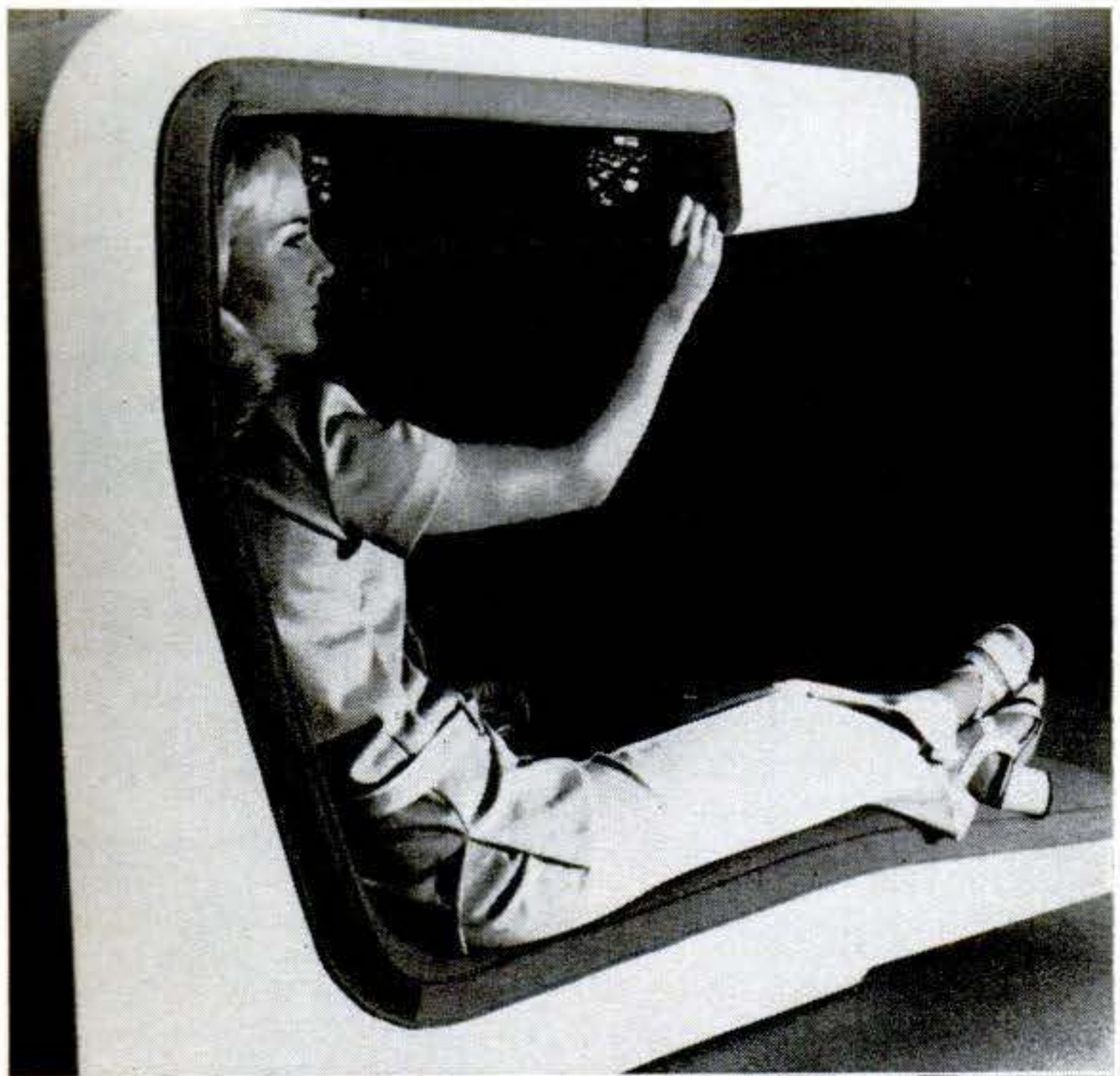


Crash dummy

This dummy is said to be the most human-like structure yet developed for crash testing. Joints and bones, under polyfoam "flesh," move like real ones. Test instruments are recessed in the skull. It was built by David Ogle Ltd. with Britain's Motor Industry Research Assn.

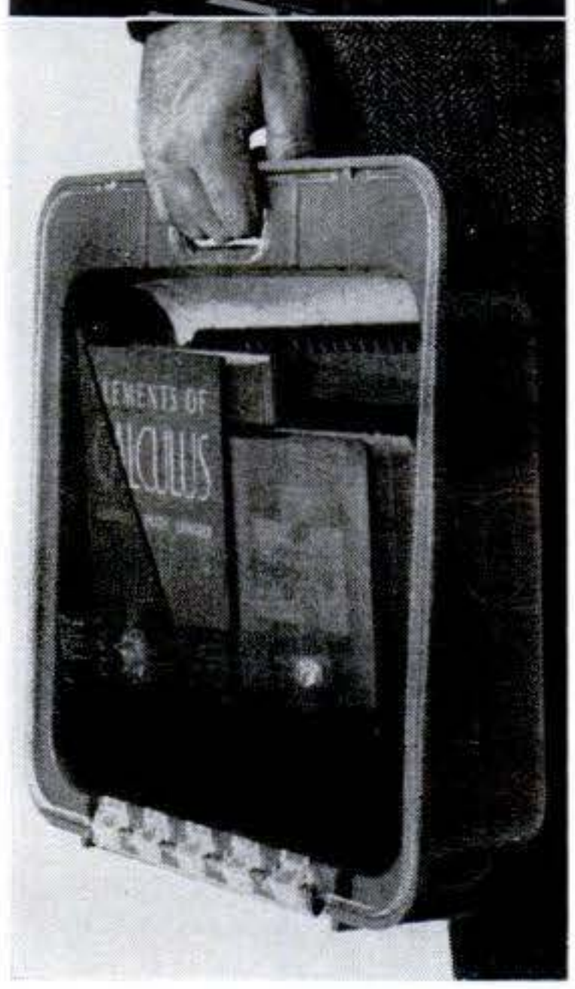
Copyrighted material

What's New



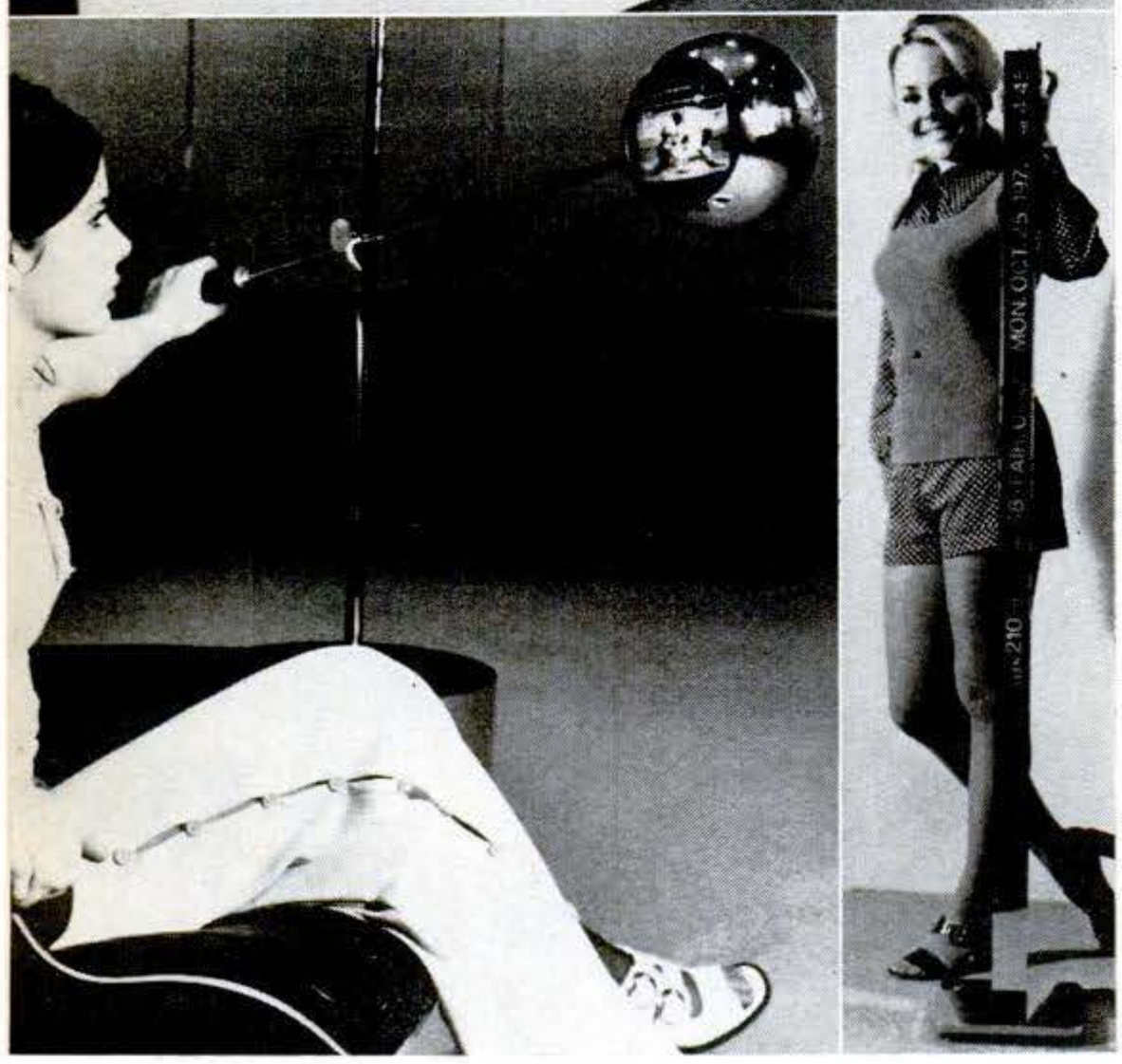
Low-risk copter

Sikorsky scaled down its big copters to come up with this proposed "low-risk" craft, the UTTAS (Utility Tactical Transport Aircraft System), shown in mockup. It has large cockpit windows for extra visibility, big aft-sliding doors for quick entry and exit of troops, and a low silhouette.



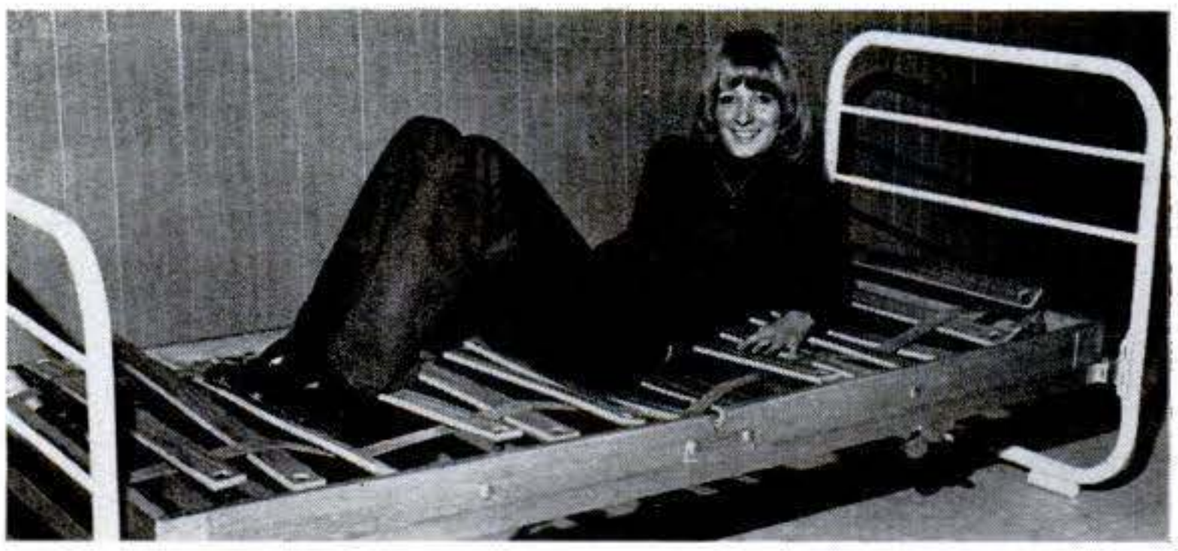
Take-along desk

Carry your desk with you? You can, with the Tote Desk. The top is flat, and of clear plastic so you can see what's inside. It's also for kids to carry games in a car, or for camping use—it holds water. $5.95 in stores. Maker is Peabody/Mutschler, North Manchester, Ind. 46962.



Out of the crystal ball: designs for the future

RCA designers have been peering into their electronic crystal ball to see what tomorrow's designs will be like. Here are some of the products they foresee, in experimental versions: The Lounge Module (top) offers color TV for two, AM/stereo FM, eight-track stereo tape, and a double lounge chair. The Video Satellite (left) has an easily positionable boom-mounted TV in a chrome ball, with controls in the handle, antenna on top of the center column. The Info-Pole (right) tells you (bottom to top) pollen count, temperature, weather, date, and time.

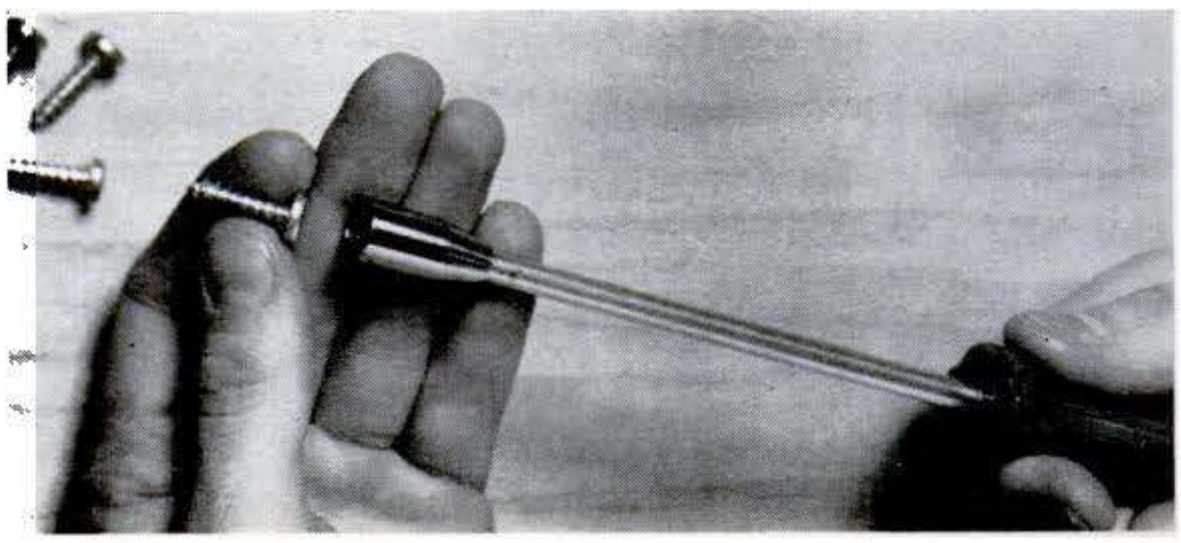


Bed and boards

Sleep on boards and like it? These boards, with canvas strips threaded through them, swivel at the ends and rise and fall to match the body's contours. The bed's maker (M. Spanoghe, 52 Rue Fr. Merjay, Brussels, Belgium) says results are dreamy.

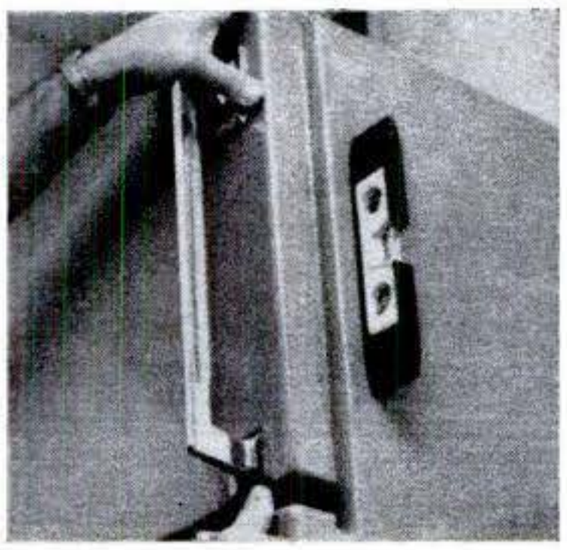
Security screws

These bald-headed screws for car radios, external hinges, and other larceny-inviting items look round like rivets, but are actually slightly oval—to fit the socket of a special driver. Maker: Australian Screw Co., 12 Hollywood Dr., Lansvale, N.S.W. 2166, Australia.



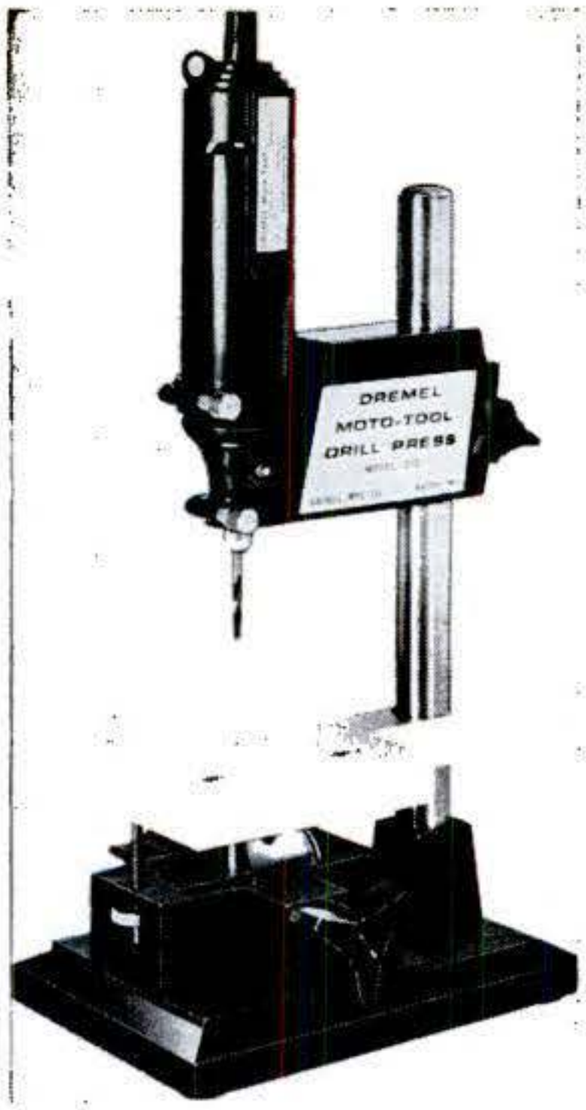
Copyrighted material

What's New IN TOOLS



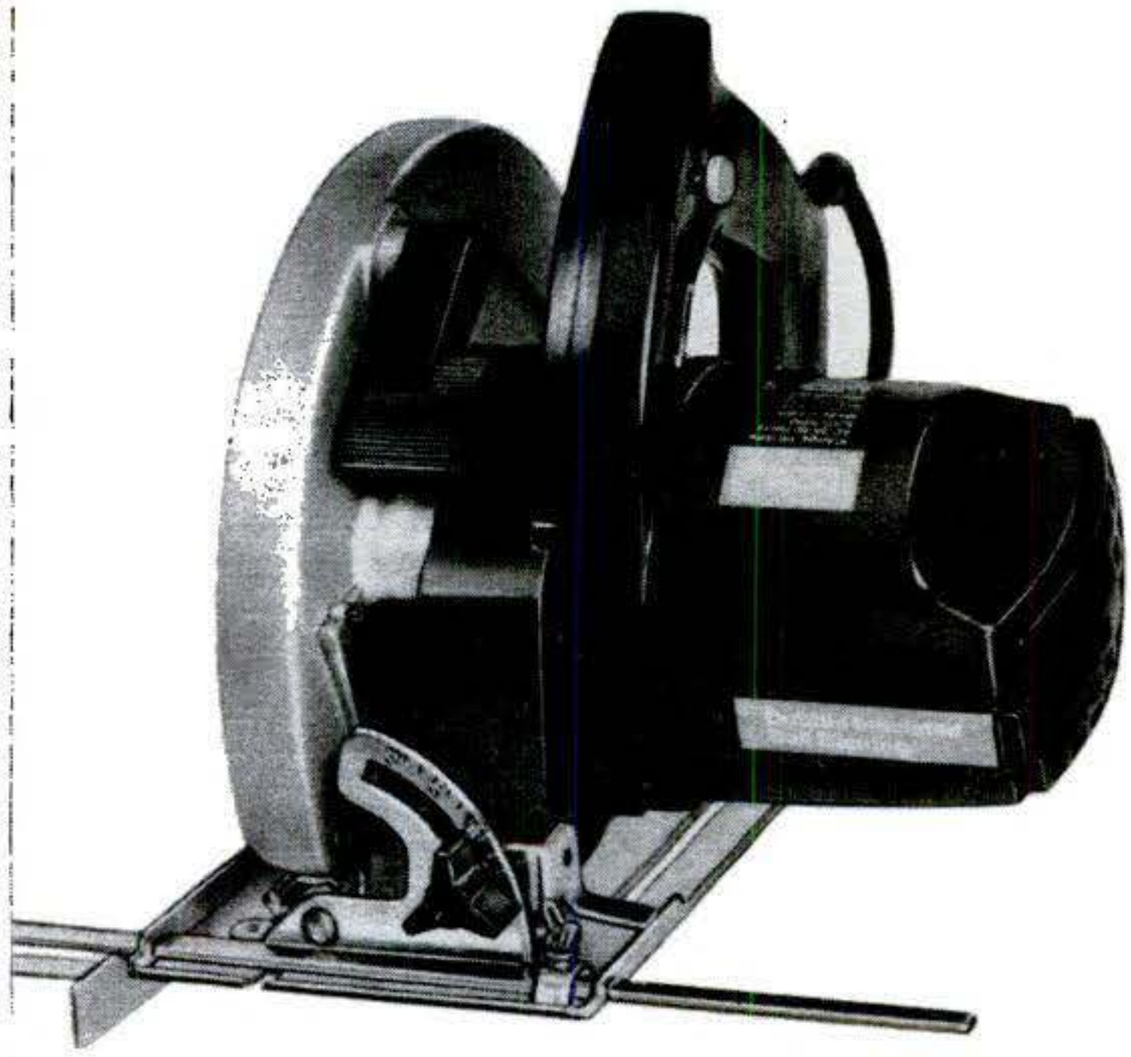
Magnetic level

Just the thing for installing a refrigerator—or any metal object—Stanley's new torpedo level has a seven-inch magnetic strip on the bottom that holds it in place, freeing your hands. The nine-inch level is made of tough plastic, has three vials, sells for $5.15. The V groove is for pipes.



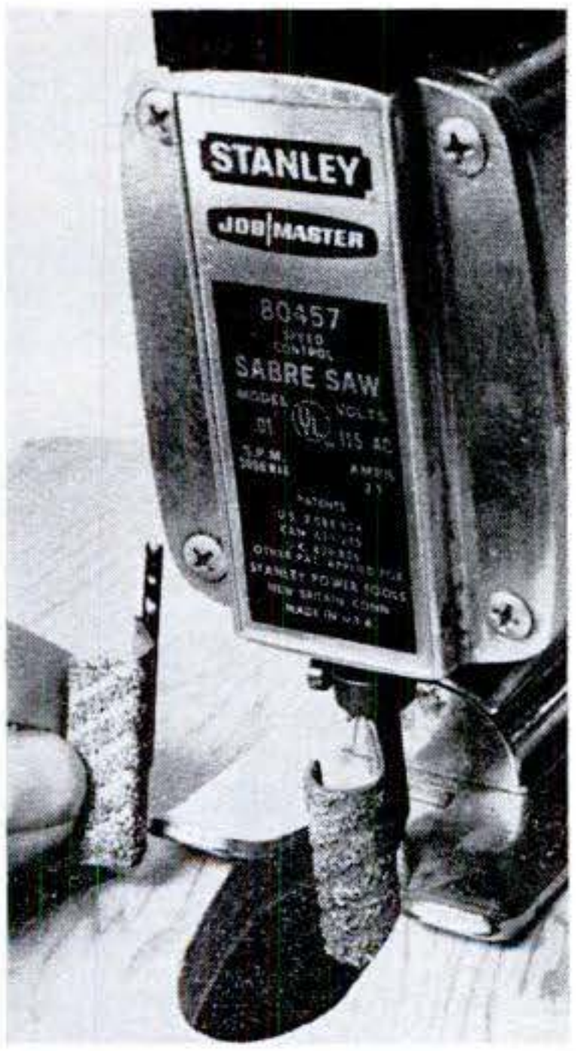
Big little press

Drilling, routing, grooving—Dremel's new 12-inch-high drill press does them all, using features usually found only on full-size units: table slots for guides and hold-downs, cam-type table-height adjustment, oversize base. It's used with Moto-Tool models 250, 260, 270, and 280.



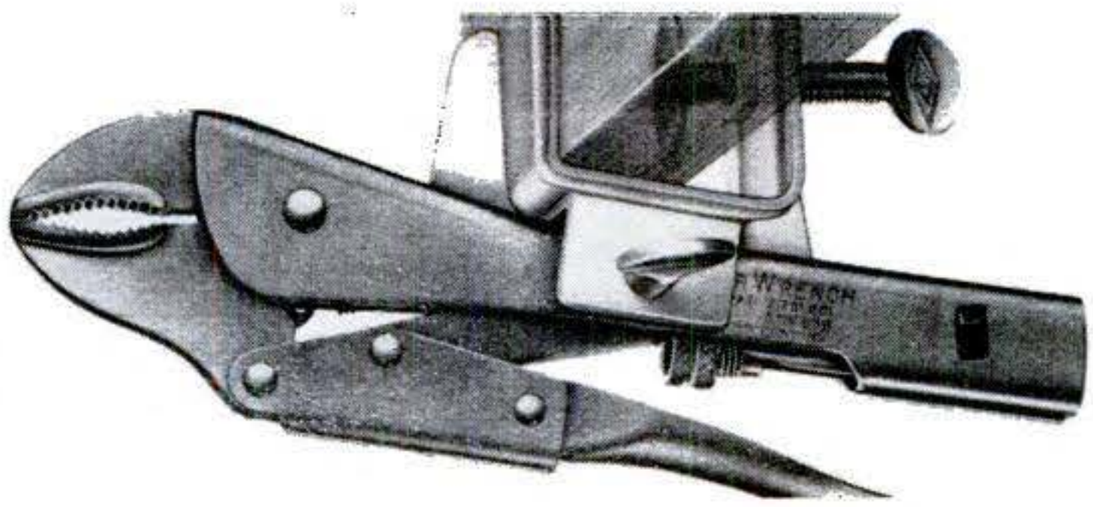
For safety: a blade guard with a lift lever

Safety's the word for this new J. C. Penney 7¼-inch circular saw. Look: Double insulation for protection against shock. An on/off button that must be pressed before the trigger can be pulled—no accidental starts. A blade-guard lift lever, between handle and guard, so you can lift the guard for pocket cuts without reaching in front of the saw (a stop keeps it from being lifted too high). Other features: 10-amp motor, sawdust-ejection system, depth and bevel controls. Model 4939 sells for $50.



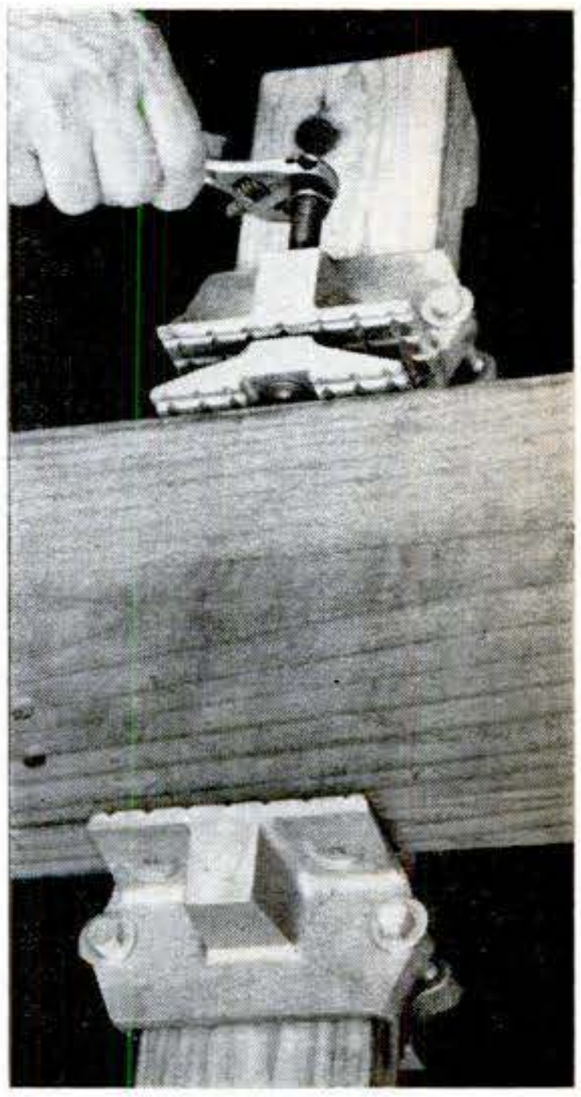
Fast filer

Fast, easy, splinter-free power filing—that's what you get with a Saber-File in your saber saw. The tungsten-carbide cutting face works even on ceramic tile and asbestos. A pair of files—one round, one flat—is $3.25 at stores. New Concepts Co., Algonquin, Ill. 60102.



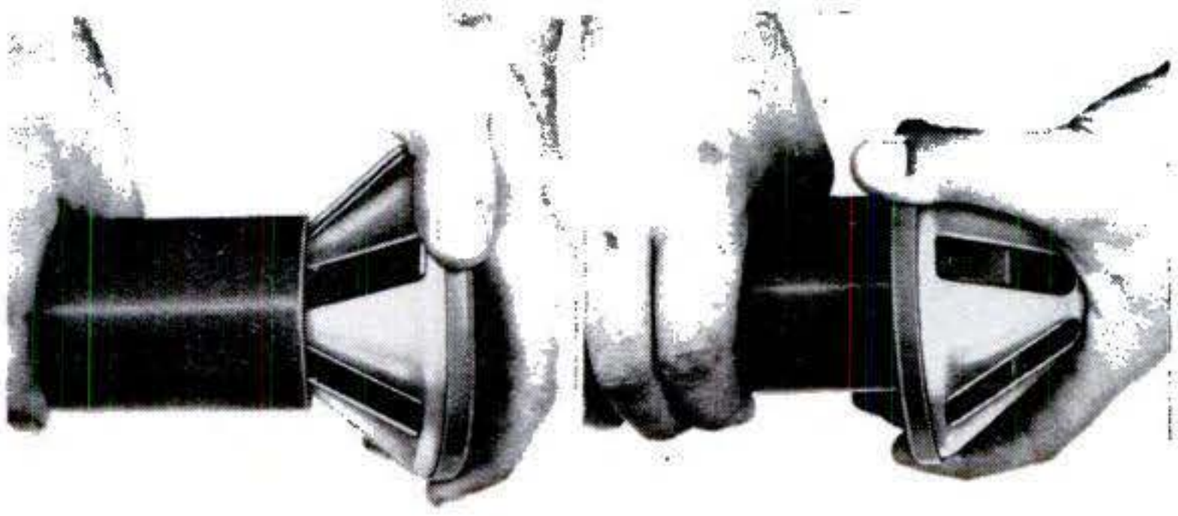
Instant vise: 1

Need a vise quick, when you're away from your shop? Clamp a LeverWrench Vise Bracket to any rigid object or structural member up to two inches thick, slip in a LeverWrench, and tighten the thumbscrew. The bracket is $2.99 from Leverage Tools, Glenvil, Nebr. 68941.



Instant vise: 2

Any two-by-four is a vise, with these big-throated cast-aluminum clamps. They'll hold doors or furniture, or can be used as a glue clamp. Two sets and two saw horses will hold anything, says the maker (Y-K Tool Co., Box 11463, Ft. Worth, Tex. 76109). $12.50 a set; two for $22.50.



Two-way deburrer

Inside or outside, it doesn't matter with this new reversible Ridgid deburring tool, designed for reaming and chamfering plastic pipe. It comes in two sizes and has a nonslip vinyl handgrip. Ridge Tool Co., 400 Clark St., Elyria, Ohio 44035, makes it.

Copyrighted material

What's New IN ELECTRONICS

Miniature recorder

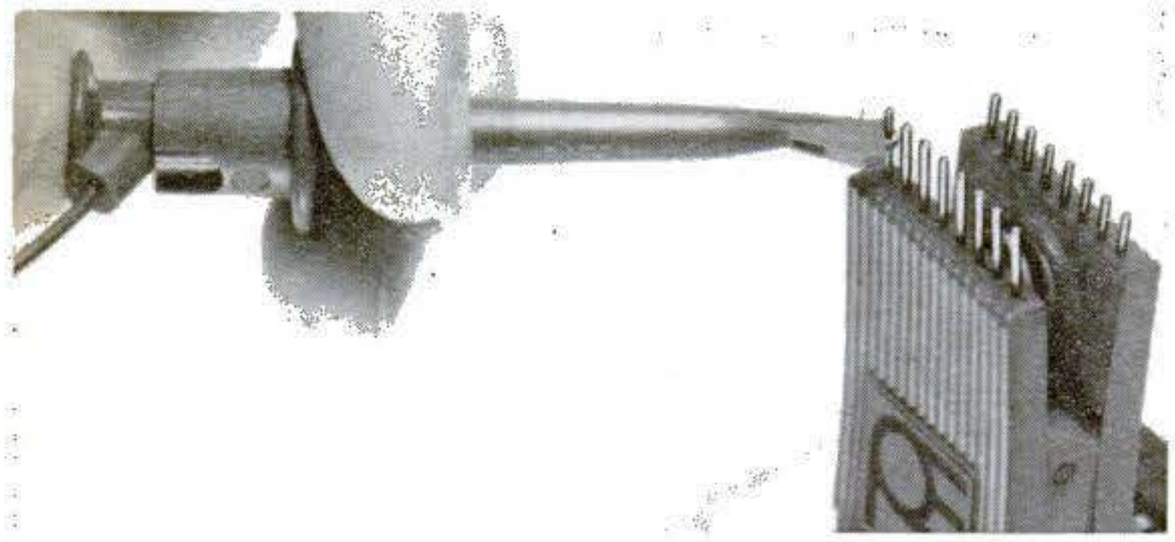
Tuck this compact cassette recorder in your pocket for note-taking anywhere. Sony's TC-55 has a built-in condenser mike and automatic shutoff. Dual flywheels and a servo-controlled motor keep tape speed constant. Price: $140. Optional ni-cad battery: $30.

Swinging radio

Here's a real swinger from Magnavox—a casual portable AM radio called the Yo-Yo. You can swing it on a chain while you walk. It features automatic volume control and comes with battery and earphone. The Yo-Yo's available in red or yellow.

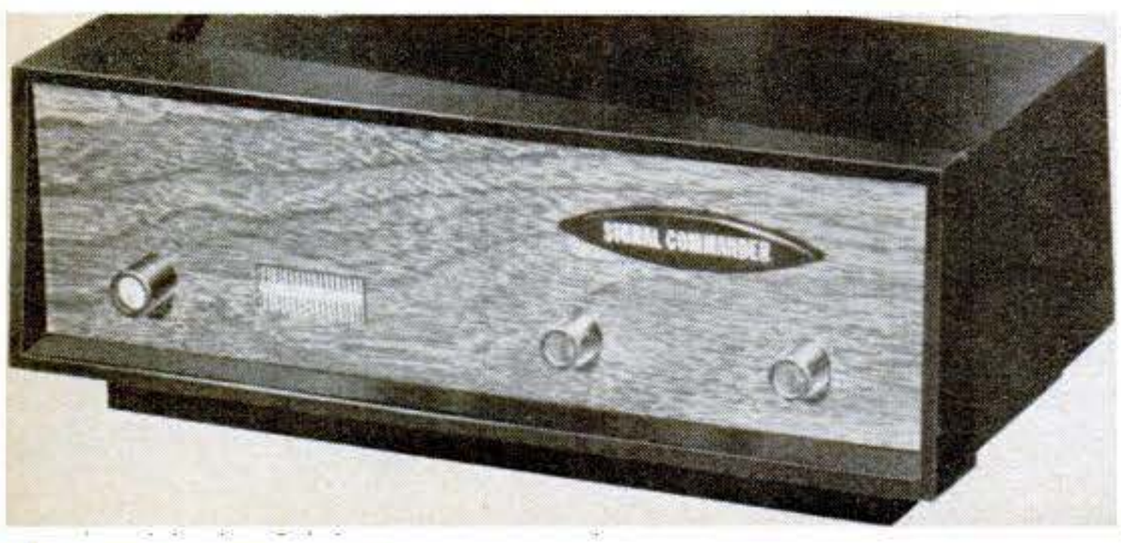
Four-channel phono

Ready for discrete four-channel records? RCA's new discs are on the market, and you can play them on Panasonic's SL-800 automatic changer, with ultra-wide-band semiconductor cartridge and built-in demodulator. The tone arm has oil-damped cueing and anti-skating control. $199.95.



IC test clip

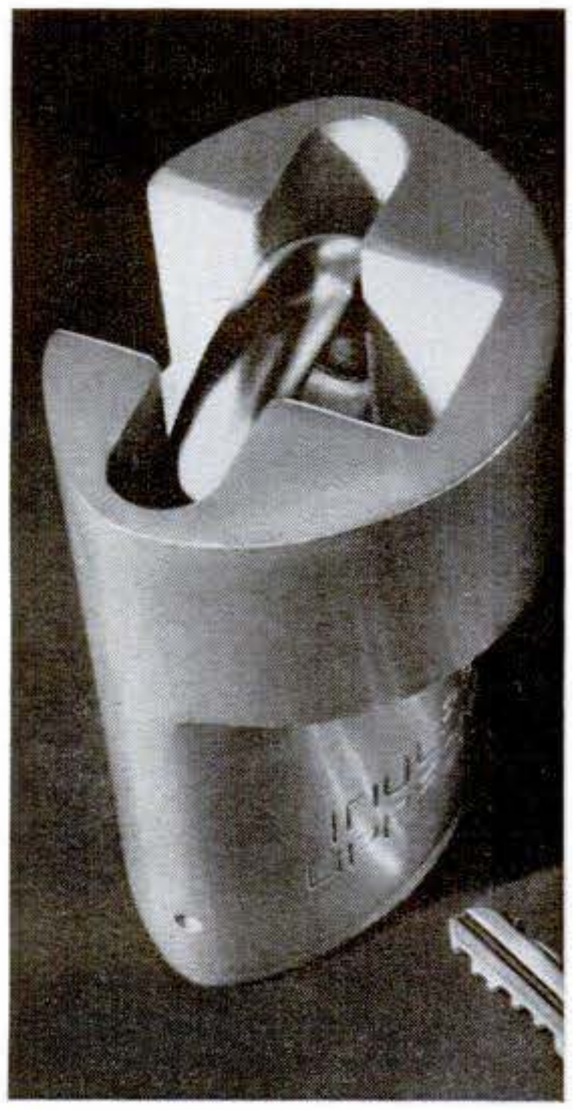
Here's a neat way to clip test probes on "hot" integrated circuits without shorting IC pins together. The Dip Clip, attached to the IC, makes testing easy by raising connections above the circuit board. It's $4.95 from Pomona Electronics, 1500 E. Ninth St., Pomona, Calif. 91766.



Hand-clap control

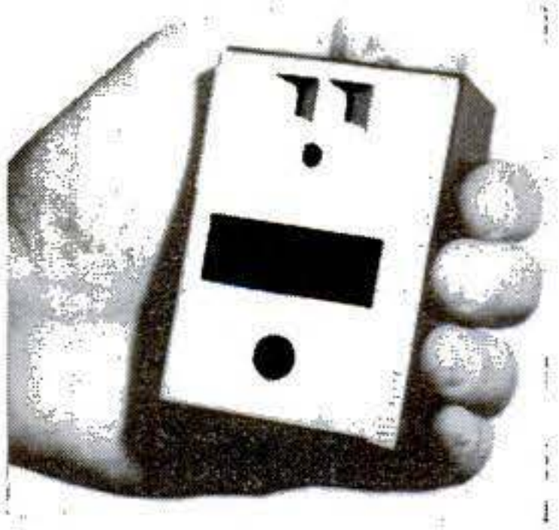
Plug anything electrical into this new Signal Commander. Clap your hands twice and it turns on—clap again and it's off. You can operate anything—up to 300 watts—from your easy chair. Signal Science, Inc., 140 Lowland St., Holliston, Mass. 01746. Price is $29.95.

What's New IN HOME IMPROVEMENT



Secure padlock

Thieves will have a tough time with this extra-security padlock—the high shoulder makes it hard to cut. The steel-clad key cylinder has 10 pivoted levers—twice the usual number. The Impregnable is made by Sargent & Greenleaf, 24 Seneca Ave., Rochester, N.Y. 14621.

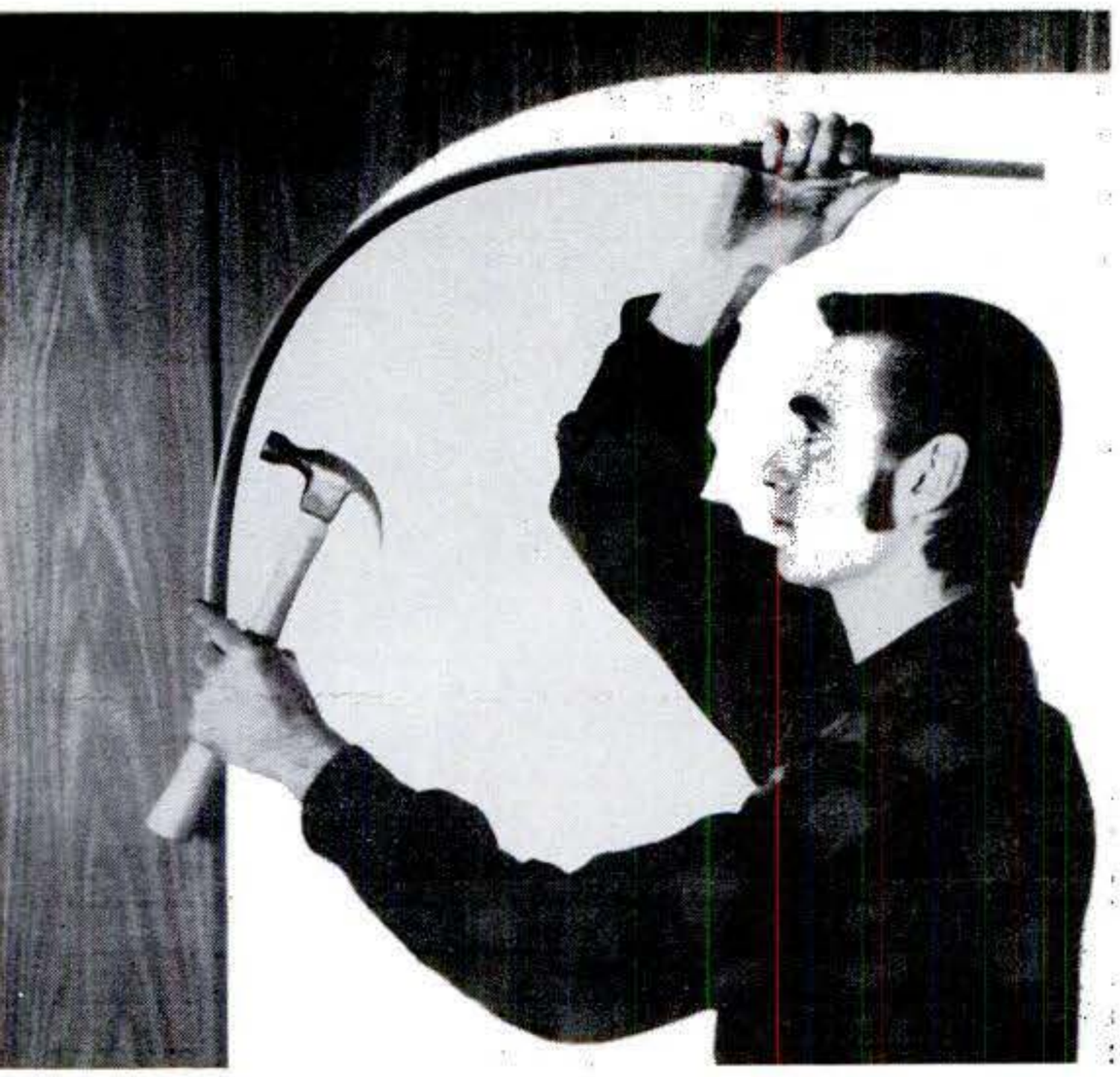


Low-voltage guard

Worried about damage to your appliances from low line voltage? First plug them into this device. When voltage drops below 100, they are disconnected. Turn-on is automatic when voltage is normal. EP-110 is $19.95 plus postage. Logitek, Inc., 42 Central Dr., Farmingdale, N.Y. 11735.

Copyrighted material

What's New FOR YOUR CAR

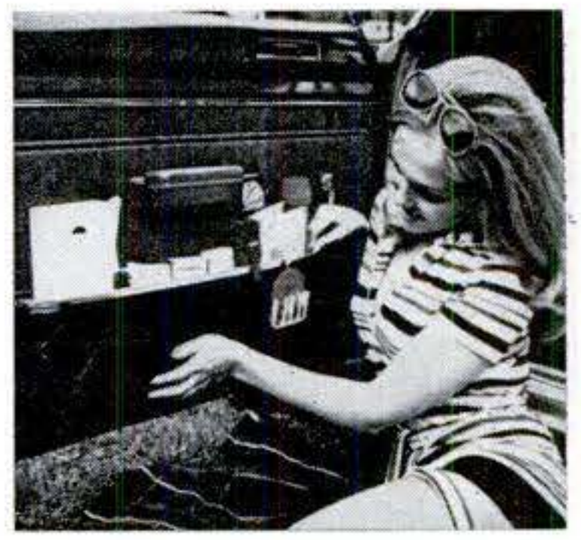


Herringbone floor

Want to give your floors a European-castle look? This hardwood flooring creates custom-designed parquet floors in the double herringbone shown or other patterns. Precision-cut strips are tongued and grooved for exact fitting. Bangkok Industries, 1900-10 S. 20th St., Philadelphia, Pa. 19145.

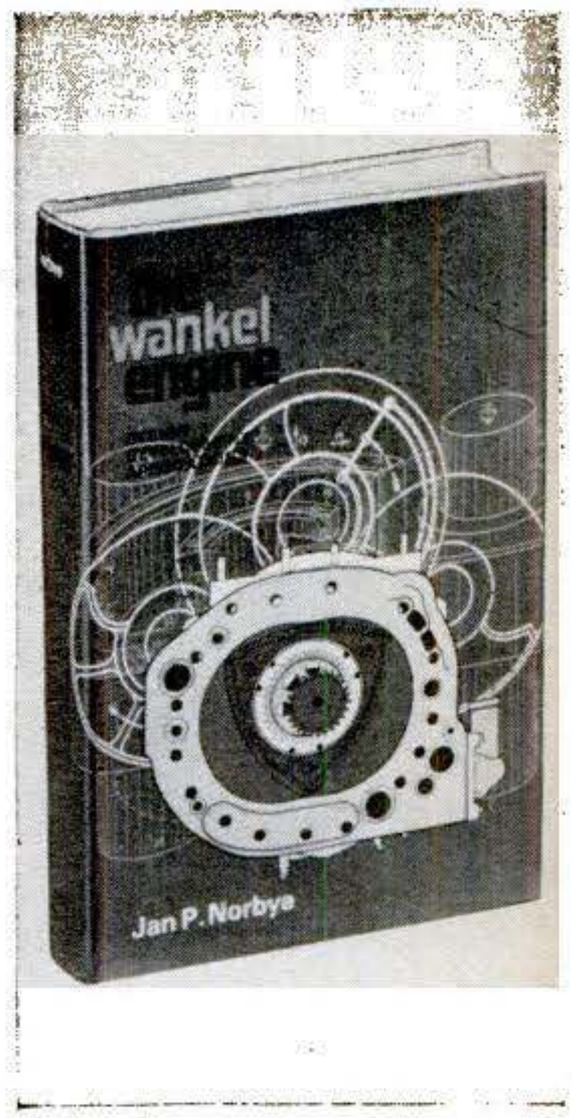
Vinyl molding

This new line of cellular vinyl molding is lightweight and easy to install. It looks and feels like prefinished wood molding, can be ground, machined, or sawed, yet bends over curved surfaces. Made by Gossen Corp., Milwaukee, Wis., it's now available at most lumberyards.



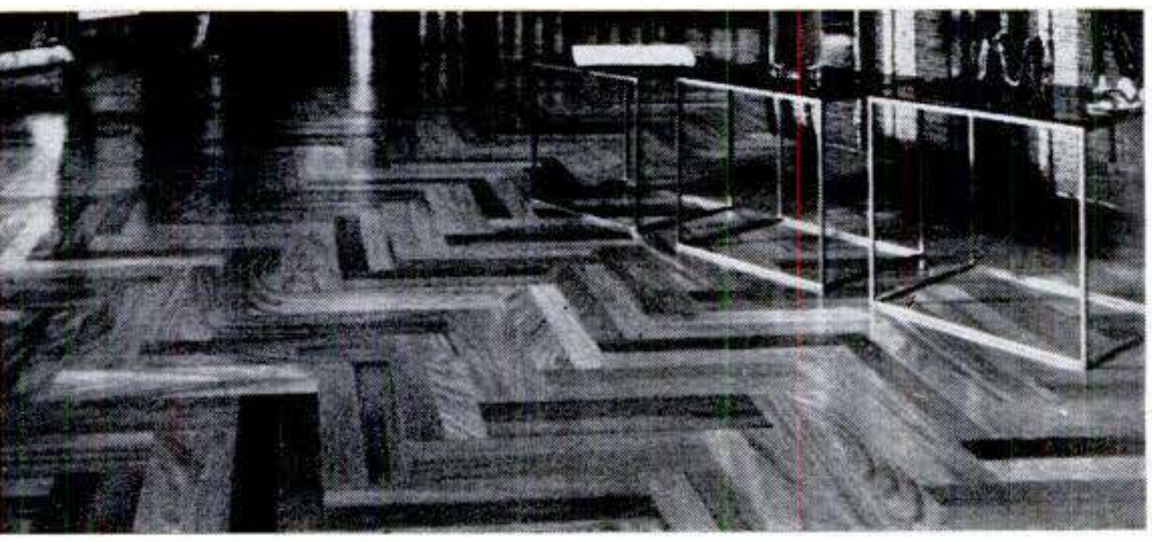
Car-door pocket

Fed up with maps and pads scattered around your car? This molded-plastic organizer on your door can help. It's just over 27 inches long and six inches deep. Made by Glass Laboratories Inc., Brooklyn, N.Y., it's available in black, $5.50, or wood grain, $6, at stores.



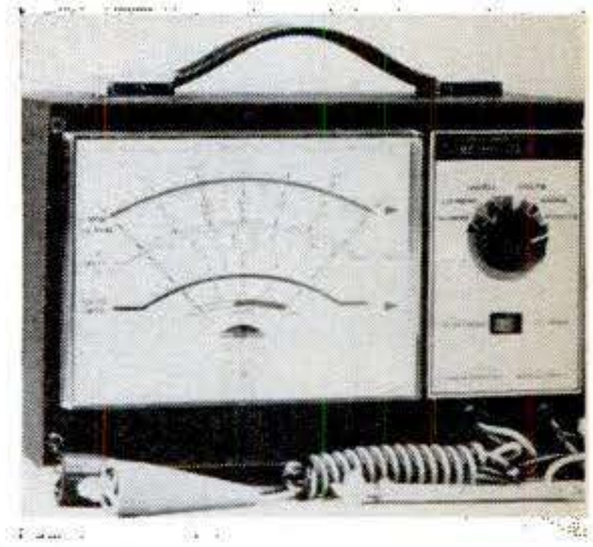
Wankel book

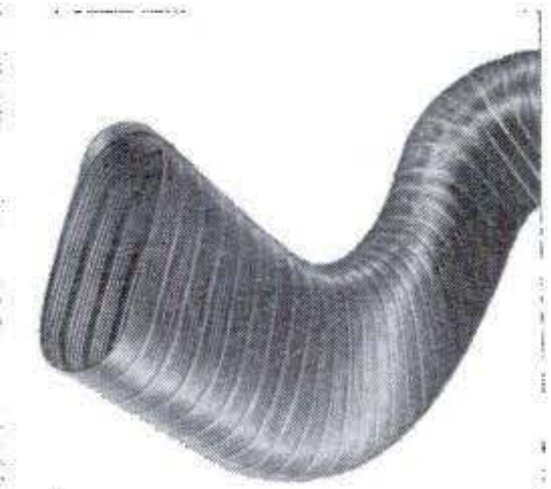
Here's a detailed look at the Wankel engine by PS's automotive editor. Three sections describe operating principles, engine development, and details on prototype Wankel-engineered cars. $14.49 plus postage, J. C. Whitney & Co., 1917 Archer Ave., Chicago, Ill. 60616.



Tune-up meter

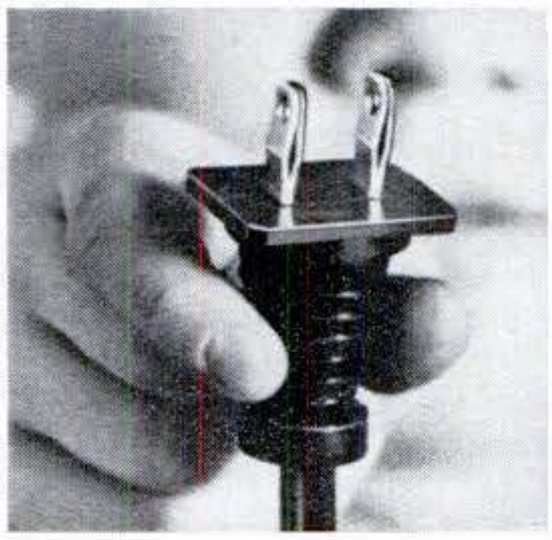
Keep any four-, six-, or eight-cylinder engine in top running condition with the Micronta Tune-Up Analyzer. The six-inch meter scale shows engine speed, dwell angle, and condition of major electrical parts. For six or 12 volts DC. $39.95 at Radio Shack and Allied Radio Stores.





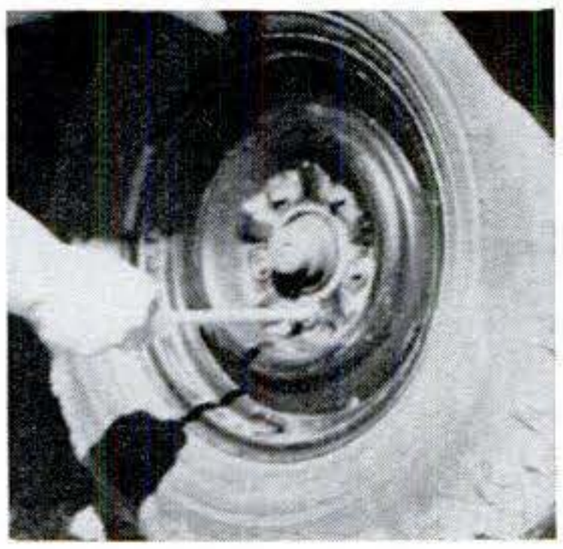
Easy-fit ducts

Here's a new look in ducts to simplify installation in tight spots. The flat-oval shape enables you to make bends, elbows, and offsets out of the shop. It's suitable for both high- and low-velocity systems. United Sheet Metal, 200 E. Broadway, Westerville, Ohio 43081.



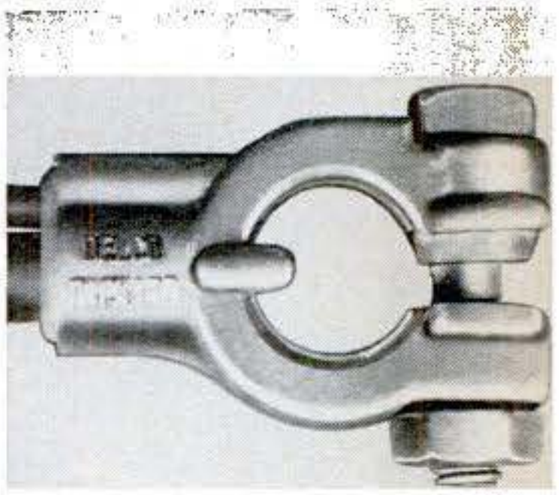
Childproof plug

Little fingers can't tangle with 120 volts AC where this plug is used. Engineered by Belden Corp. for electrically operated toys, it has a safety flange at the plug face and a finger pull at the back. You're likely to see this design in other uses where more safety is needed, says Belden.



Rim rod

Try a little leverage to make tire changing easier. The Rim-Rod slips through a lower wheel hole and onto the tip of the lower stud. When you lift the rod, the wheel slides easily onto the studs. It's $2.48 from Improvement Enterprises, Evan City, Pa. 16033.



One-way terminal

There's a new twist to Delco's battery cables—so you won't twist them upside down when connecting them. A stop on the terminal's top side does the job. Delco calls it PTC—Proper Terminal Connection. It's cast to fit either battery post without forcing and damaging the battery.

Copyrighted material

What's New IN BOATING

Outlet adapter

Now a single dockside outlet can supply power to two boats. The Y adapter at right splits a 50-amp, 250-volt marina service outlet into dual 30-amp, 125-volt outlets. A spring-loaded clamp connects to the metal conduit for grounding. It's from Harvey Hubbell, Inc., Bridgeport, Conn. 06602.

Trim-tab kit

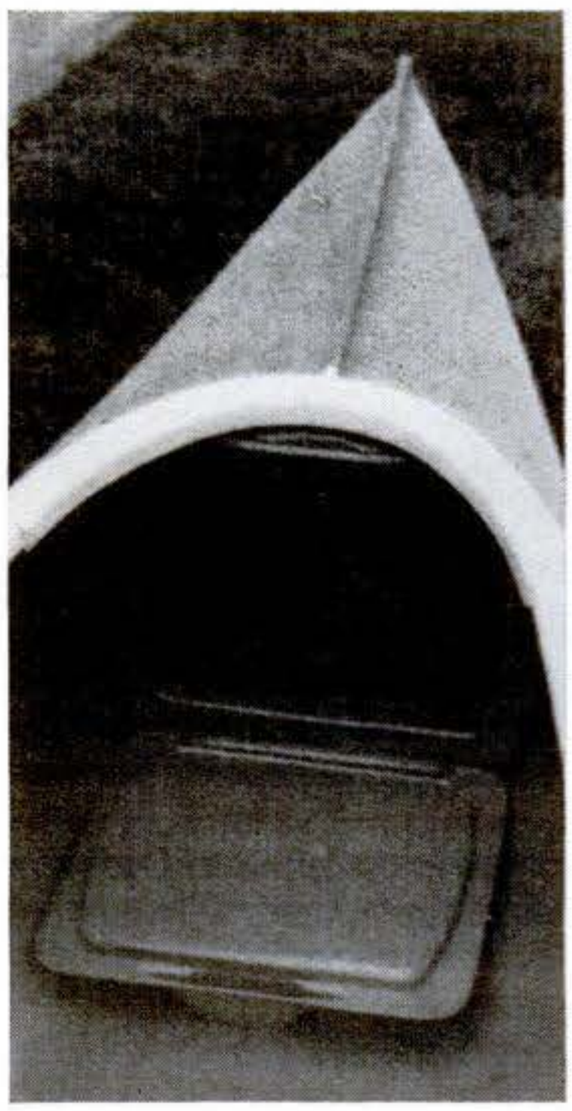
When a boat needs trimming because of unbalanced load or abnormal wind and water conditions, these helm-controlled trim tabs may do the trick. Insumatic Totaltrims ($149 to $279) use the boat's wash for power. ICM Marine Products, 322 S. Michigan Ave., Chicago, Ill. 60604.

Boat buggy

Here's an easy way to get your sailboat to the water: Roll it with a four-wheel Fish Cart Buggy. Padded chocks adjust to the hull shape; nylon straps secure the boat. Wheels are inflatable. $79 from Williams Mfg. Co., Box 23, Wyncote, Pa. 19095.

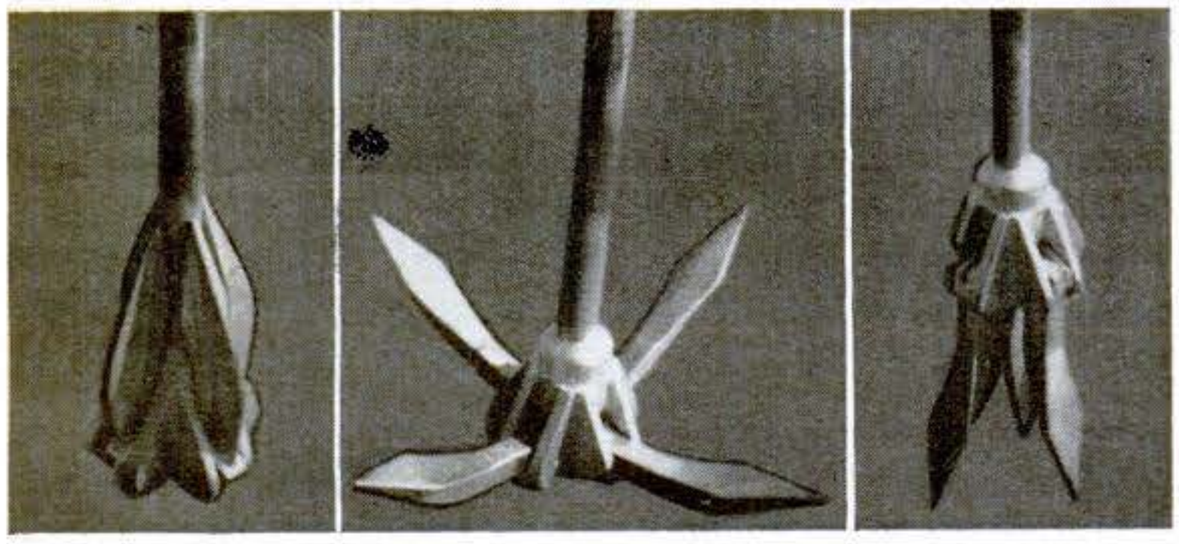
Inflatable canoe

Want a little canoe that's inexpensive and practical? Sears' new two-man Pyrawa canoe features six independent air chambers in the shell and two three-chambered removable seats. The orange-and-blue inflatable will carry 405 pounds. $91 at most Sears stores and through the catalog.



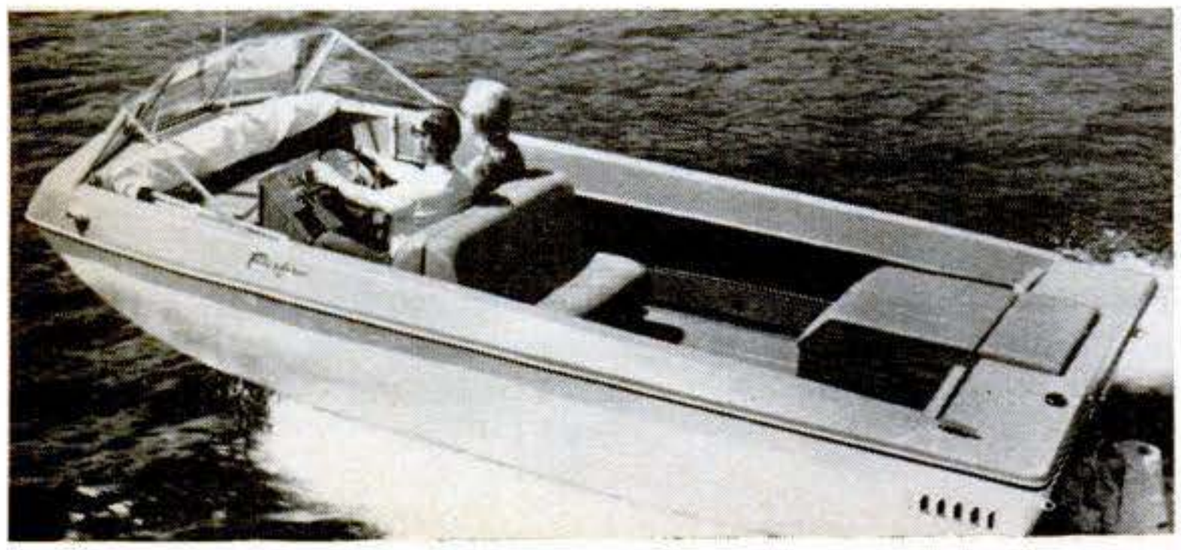
Canoe storage

What a way to go canoeing! Built-in foam-insulated compartments in both bow and stern of the Whitewater ABS canoe keep food, beverages, and fish cool for hours. Two lengths: 15 and 17 feet. Malbar Plastics Inc., Box 367, Newton, Iowa 50208.



Drop-fluke anchor

If you're tired of losing anchors, Snag-Pruf may be for you. Photos show the three stages of the 10-pound drop-fluke anchor. A line lets the hooks collapse, eliminating snag surfaces. $24.95, from G & G Crafts, Box 1401, Enid, Okla. 73701.



Tri-hulled runabout for family fun

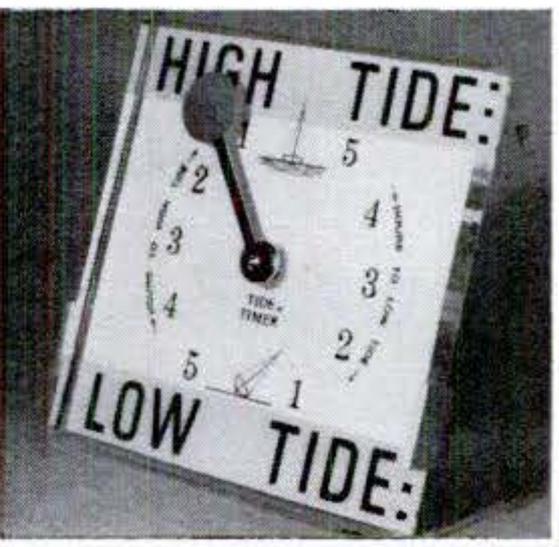
Here's a versatile family boat that you can use for fishing, skiing, swimming, or cruising. The 16½-foot tri-hull Bowrider is available in both outboard and inboard/outboard models. It features center steering console, wide fold-down sleeper seat, and full-width lounge seat. Standard equipment includes convertible top, full deck hardware, running lights, and mechanical steering. Weight: about 1,400 pounds without engine. It's made by Fiberform, Building 20, Spokane Industrial Park, Spokane, Wash. 99216.

Copyrighted material

What's New IN OUTDOOR RECREATION

Pencil-beam light

Put a parabolic reflector behind a 100-watt quartz-iodine element and you have the Cibie 7000-Search—according to the maker 'the most powerful seven-inch marine searchlight.'' Range: 1¼ miles. It's $39.95 from Mowsts Searchlight, 26941 Pebblestone Rd., Southfield, Mich. 48076.



Tide teller

Need to know the tide's highs and lows? Just slip in a C battery, and Tide Timer—working on moon time—tells you the next change. Two sizes: Six by six inches ($30.25) and 12 by 12 ($60.25). Schelling Hardware Mfg. Corp., 734 Willow Ave., Hoboken, N.J. 07030.

Cordless clock

This new cordless clock is only three inches in diameter—great for a boat with limited space. Timecrafters Model 721 has a fully jeweled electronic movement, 1.5-volt battery, 24- and 12-hour markings. Price: $45. Timecrafters, Commerce Campus, Middlebury, Conn. 06762.

Rotating sun deck

For an even tan, how can you beat a rotating sun deck? The Sunmobile rotates 12 times every hour. It comes with two chaise longues and a cocktail table for $695. Want an umbrella? $75 extra. HM International, Box 20835, San Diego, Calif. 92120.

Remote level

Leveling your trailer is easier if you can do it from the driver's seat. This level mounts on the trailer front, in view of the driver. A steel ball in a curved tube tells you when all's well. It's $12.95. Maker: Tamarack Engineering, 9050 S.E. 137th Ave., Portland, Ore. 97236.

Coin finder

Lost knives? Car keys? Coins? Here's a low-cost way to find them, with the new Coinmaster 1 TR-AM. A transmitter-receiver instrument, it operates on a frequency of 100 kHz. A buzz signals the presence of metal. It's $99.50 from White's Electronics, Sweet Home, Ore. 97386.

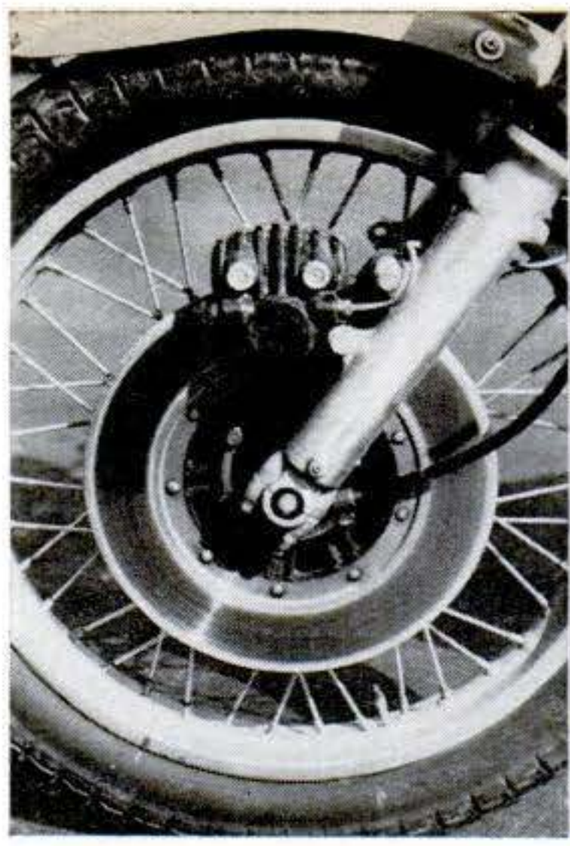
Ski foils

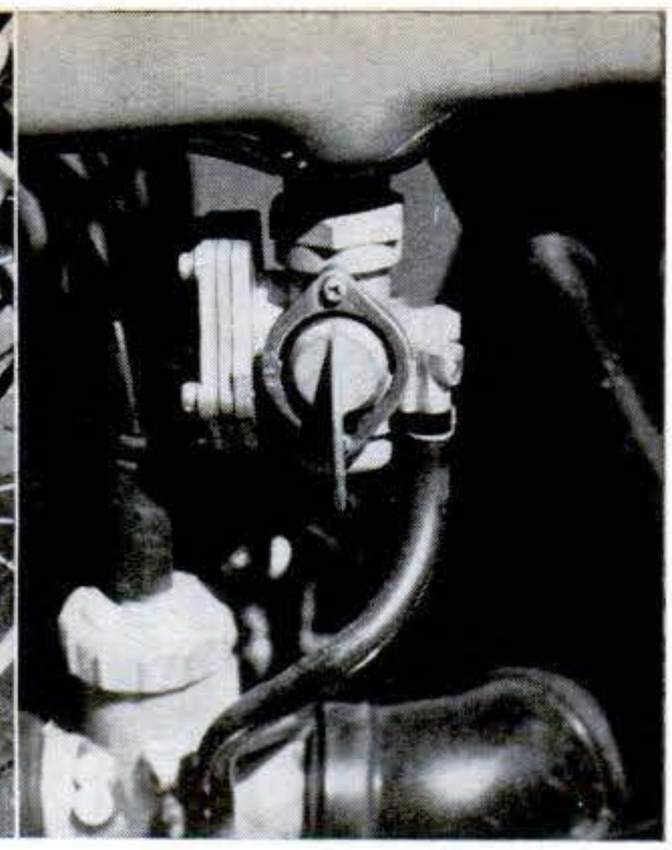
Now you can "fly" on water skis with Dynaflite Hydrofoil attachments. The foils go on any skis, pick you up two feet out of the water, and allow you to ski as slow as eight mph. Standard (24-inch) foils are $41.95 from Custom Dynamics, 119 River St., Waltham, Mass. 02154.

Blow-up kit

Flat tires on your bike, or limp basketballs and footballs—the pocket-size Airjet inflates them the no-work way. Secret: a CO_2 cartridge. Price: $6.95. Maker: Thompson Designs, 445 Factory Rd., Addison, Ill. 60101.

Copyrighted material





Front disk brake is a real stopper—requires little pressure to activate it. Fuel tap, right, lets you forget about turning off the gas at the end of the day. A diaphragm valve inside automatically shuts off the fuel passage when the engine stops.

KAWASAKI'S GO-GETTER:

Three 250cc Cylinders Give All the Power You'll Ever Need

By **RAY HILL** PHOTOS BY ORLANDO GUERRA

750 SPECS

Engine type	3 cylinder, 2 cycle
Horsepower	74 @ 6,800 rpm
Displacement	748cc
Bore and stroke	2.8 x 2.48 in.
Starting	kick
Lubrication	oil injection
Ignition	magneto CDI
Weight, dry	422 pounds
Wheelbase	55.5 in.
Ground clearance	7 in.
Clutch	wet, multi-disk
Transmission	5 speed, constant mesh
Gear ratios	1st: 2.17:1
	2nd: 1.47:1
	3rd: 1.11:1
	4th: 0.92:1
	5th: 0.81:1
Price	$1,445

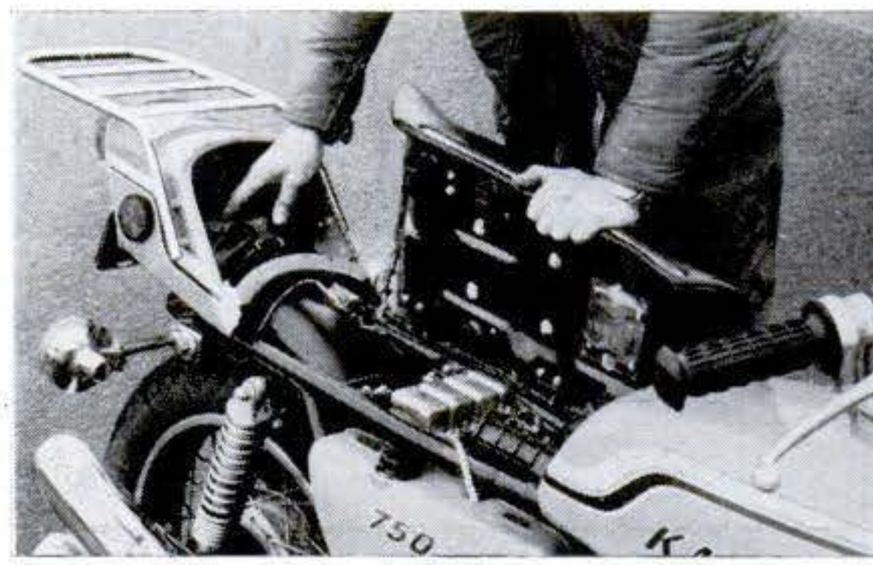
Even up close, Kawasaki's new 750 doesn't look big. Don't let that fool you. It's one of the fastest motorcycles you can buy. I tried one out recently on 2,000 miles of interstate, city, and back roads across seven states, then rode it to New York's Bridgehampton Race Circuit, where I could really twist the bike's throttle.

The track was wet and wheelspin occurred at takeoff. Even so, the machine zipped from 0-60 mph in five seconds, 0-80 in 8.2 seconds, and 0-100 in 15.2 seconds.

Great, you say. But what good does all that speed potential do you

Mild 7:1 compression ratio makes it easy to kick the big 750cc engine over. Author Hill found that the bike started readily, even when it sat for days without running.

Ignition switch is easily accessible—between the speedometer and tach. The horn, turn signal, and light switches are next to the left handgrip—an easy thumb reach.



Tool kit behind seat has all tools needed for normal maintenance. Except for occasional chain adjustment and changing plugs at 2,000 miles, Hill never needed the kit.

Copyrighted material

on the highway? Just this—when you want to pass a car, or you look in the mirror and see a big trailer truck barreling down on you as if you weren't there, you can go forward—fast. Those three cylinders churn out a whopping 74 hp at 6,800 rpm to give you something else, too: the power to ride into a strong headwind at normal cruising speed.

I rode the 750 from New York City to Tennessee and back one weekend —an 1,800-mile round trip. Almost half of those miles were through pouring rain; brakes and engine received a lot of water spray. The brakes never grabbed, and the engine never missed a beat.

Starting was always easy. One night I left the bike out in the rain. Still wet the next morning, it started on the first kick. Even after several days without being ridden, starting was easy.

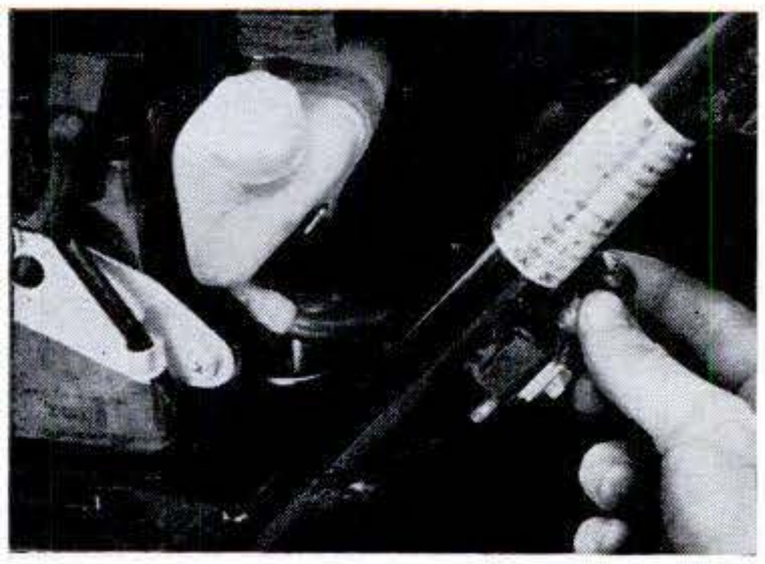
Gear shifting is a breeze, too. Press the shift lever all the way down and you're in neutral. Lifting it up with your toe lets you go through all five gears, one at a time. It's almost impossible to miss a gear.

The front shocks and three-position adjustable rear shocks provide excellent suspension. Brakes? The front disk and internal-expanding rear brake are more than adequate to bring the 750's 422 pounds to a stop in a hurry, even at speeds above 100 mph.

In heavy stop-and-go city traffic, I was pleasantly surprised. This is one two-cycle engine you don't have to rev up to produce enough torque to take off. It's right there, even at low rpm.

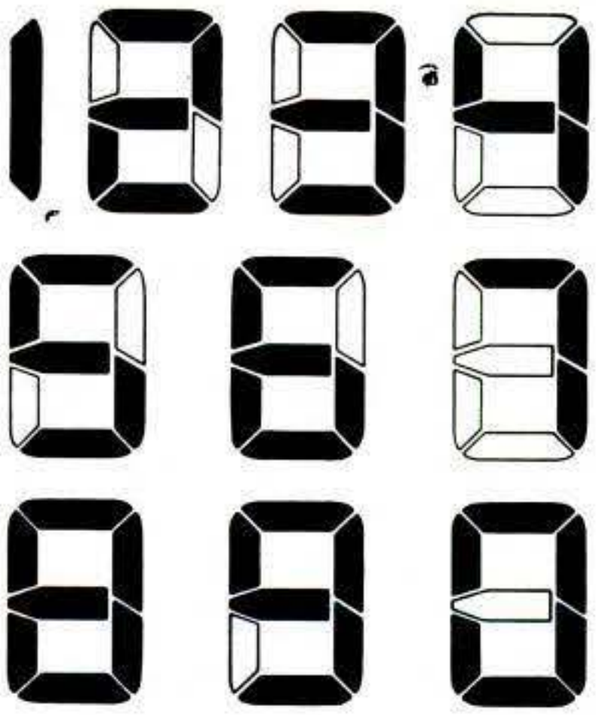
If by now you think I'm enthusiastic about this machine, you're right. During my total of 2,300 miles I found only two problems that might annoy some riders. At 70 mph, gas mileage was only 23 mph. And at all speeds, there's some vibration in the handlebars.

All things considered, I think this is a great motorcycle. You'll have to search a long time to find a better machine. PS



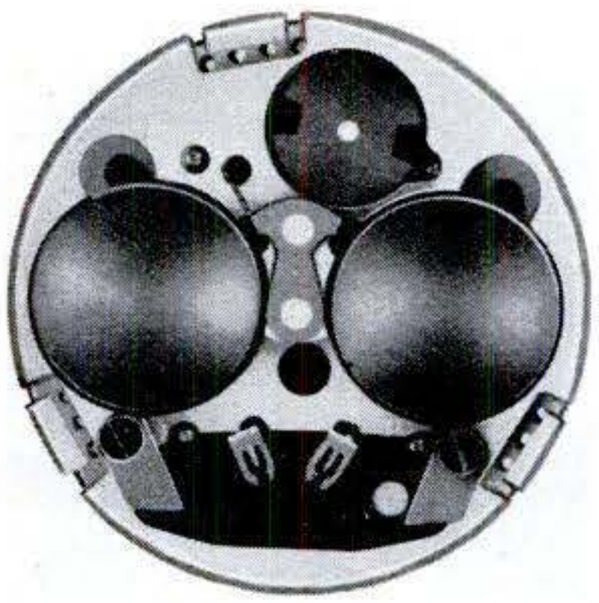
For easy chain lubrication, Kawasaki provides a chain oiler on the 750. The little white tank holds the lubricant. Pulling the oiler knob lets oil drip on the chain.

NEW QUARTZ WATCHES: Liquid Crystals Tell the Time



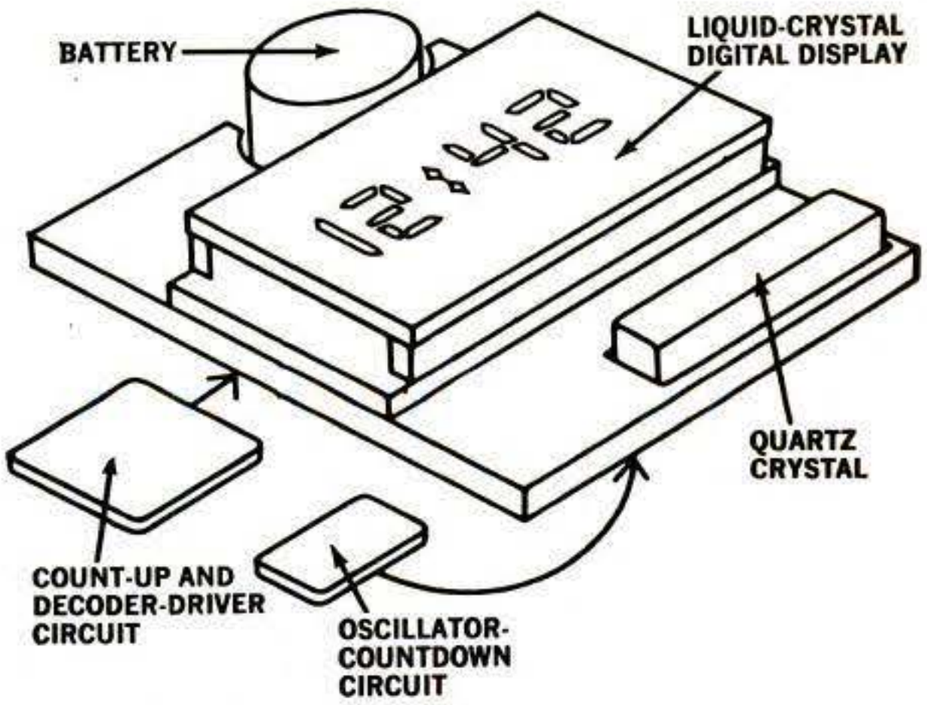
Seven crystals show any of 10 digits. Battery's voltage causes liquid crystals to reflect and scatter ambient light.

Swissonic 2000 tells hour, minute, second, and (top) date. Time is based on 24-hour clock.



Two 1.35-volt batteries power Swissonic. Integrated bipolar circuits count down the frequency.

Walchron tells hour, minute; colon flashes every second. Watch is accurate within five seconds a month.



Inside the Walchron: One 1.5-volt battery powers the watch. The oscillator-countdown circuit successively halves the quartz's 32,768-Hz frequency to 64 Hz. The count-up and decoder-driver circuit (on one IC chip) divides the frequency into seconds, minutes, and hours. LCs then light up to tell you the time.

Six months ago the latest thing in time-keeping was the quartz watch [PS, Jan. '72]. Out went balance wheels and tuning forks; in went slivers of quartz, making timepieces accurate to a few seconds a month.

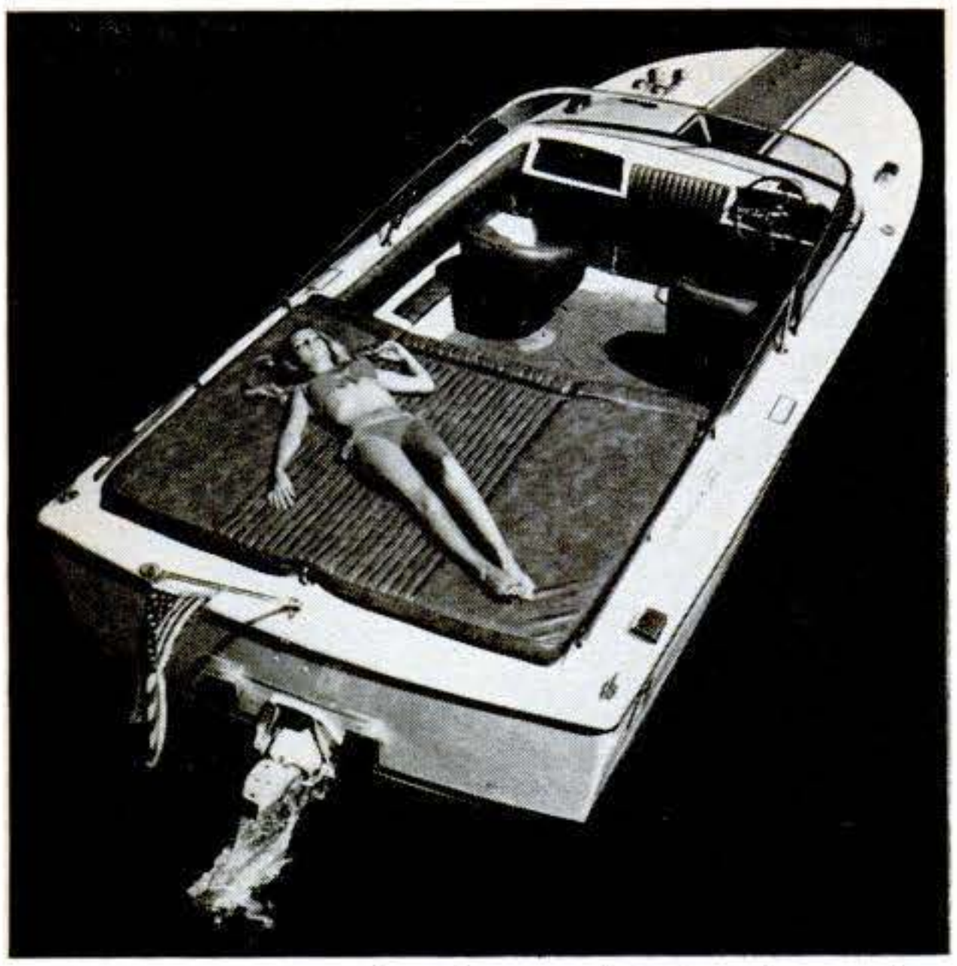
Now the watch industry is taking away the hands, too. How? By using liquid-crystal digital readouts ["Liquid Crystals: Those New Electronic Showoffs," PS, Feb. '72]. Waltham's Walchron goes on sale this month for less than $200, and Ebauches S.A.'s Swissonic 2000 will cost around $300 later this year (under different brand names).

No moving parts. The LC watches are true *electronic* watches. Unlike the old quartz movements, these have no stepping motor.

LC watch displays differ from the Hamilton Pulsar's digital display [PS, July '70]. Pulsar has an LED (light-emitting diode) readout that draws more power. (To conserve power, the Pulsar's LEDs light up only when you push a button.) There are problems with LCs, too. They don't have unlimited lifespans. Eventually (one company claims five years) you'll have to have the jeweler change the display (for about $10). Also, LCs rely on ambient-light intensity. The less light available, the harder they are to see.

Quartz prices are dropping now, and Omega, Seiko, and Longines (at $250) plan to market LC watches.—*Doug Garr*

Copyrighted material



A BEAUTY at rest, the Chris-Craft XK-22 is one hot cat in action—50 mph with the 350-hp I/O mill.

WINNER GTX has a deeply stepped hull for moving up to top-speed position fast. The 16-foot, six-inch craft has full flotation built in.

PS BOATING

HOT SHOWOFFS...the wild

These high-speed hustlers—usually 40 mph and up—perform so well because they're brilliantly designed and carefully made

By **JIM ROE** / *PS Boating Editor*

Really fast boats are here. You can share a brand of thrills once reserved for a handful of racing drivers in one of the high-performance boats now available.

Their bloodlines are the all-out racing machines that have been perfected in the last 10 years to go at very high speeds for sustained periods. Names like Bertram, Donzi,

CIGARETTE 24, designed by Don Aronow: 57 mph with 188 hp. It's a takeoff from his 36, world champ for last three years.

WELLCRAFT NOVA is a 25-footer designed to handle twin 188-hp stern drives. Hull's a deep-V design, strongly built.

THEY'LL DO MORE than just race. Avenger 18 (foreground) and 16-foot Baby Donzi are excellent ski boats and runabouts.

Copyrighted material

JET POWER with a 455-cu.-in. engine moves the Glastron-Carlson CV-21 like a super sports car. Skillful engineering and careful building is evident throughout. Note how windscreen frame provides a handhold that's never out of reach.

and wet way to go

Cary, Monza, Cigarette, Magnum, Formula read like a roster of world-wide competition winners. Today, all are producing boats the public can enjoy.

Typically these are carefully made, comfortable boats with superb handling characteristics. Design and engineering of the most imaginative and skillful sort have gone into them—produced winners in racing—and are there now for anyone who dares to buy and drive one.

A secret of these boats is their long, narrow hulls. In some the ratio approaches 4:1. Many are deep Vs, with longitudinal bottom strakes to provide lift, reduce wetted surface. Bows are usually quite fine in entry, reducing the tendency to pound at high speeds.

Actual speeds depend on the power you opt for, of course. The tab—you opt again: Winner's GTX, a modest runabout, is $1,799, plus outboard. Cigarette 24, the all-out speed boat, is $15,290 with a 188. PS

MAGNUM makes several high-perf boats. This tunnel-hull skimmer, an earlier Aronow design, did 61.6 mph with a 125.

BABY DONZI'S power options go zoom: 100-hp outboard (42 mph), 140-hp outboard (50 mph), 290-hp inboard (56 mph).

CUSTOM DESIGNS are in the running when it comes to boats made purely for speed and performance, like this needle-nose midget.

Copyrighted material

FORD LTD front and rear bumpers extend about four inches from the body. Sheet metal is all new but carries familiar styling theme. As flagship of the Ford line, the LTD shuns radical changes in appearance.

SNEAK PREVIEW OF THE '73 MODELS:

Year of the Bump-Proof Bumper

BUICK SKYLARK four-door sedan (left) has six side windows for better side and rear view, lower beltline for modern profile.

MUSTANG (right) continues with minor changes. Top-line model sports special "clean" bumper and face-lifted front end.

OLDSMOBILE F-85 front view shows off the wide stance and the enlarged windshield, as well as the new front bumper.

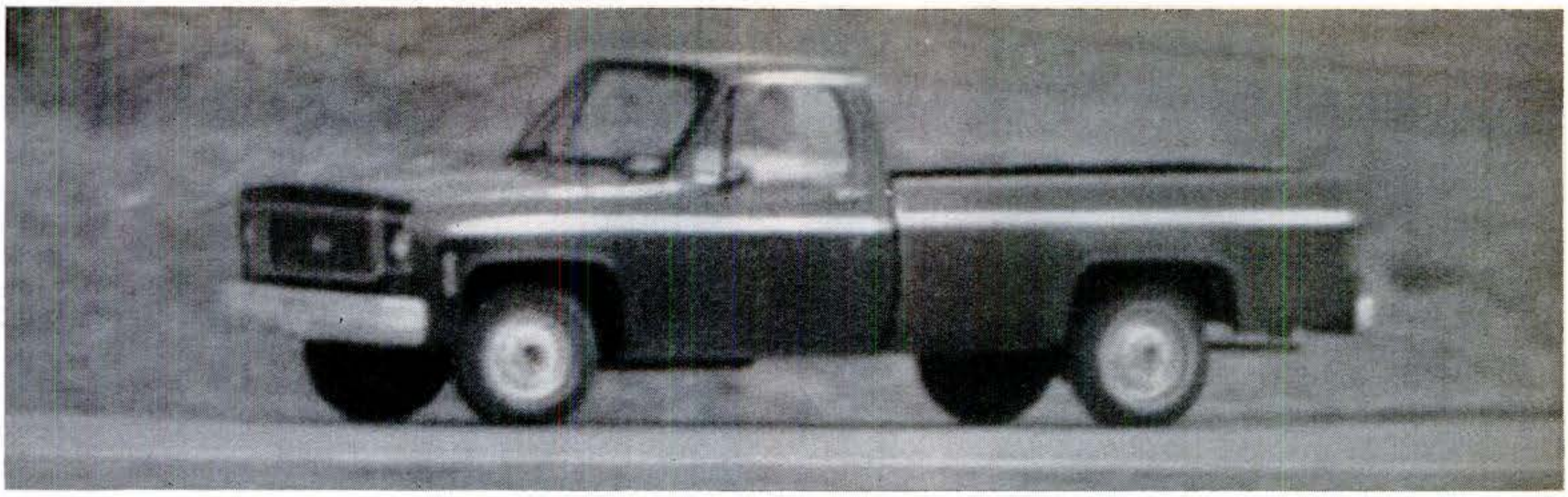
MERCURY MONTEREY shares the basic body with the full-size Fords, and carries the same front and rear bumpers.

CHEVELLE's all-new body has side windows in C post behind rear doors, improved space utilization and seating comfort.

FORD GALAXIE two-door hardtop comes with a formal roofline Bumpers are the same as the LTD's (see top of the page)

CHEVROLET MONTE CARLO is basically the same as the Chevelle from the windshield back, with its own distinctive roofline.

Copyrighted material



CHEVROLET PICKUP TRUCKS have been totally redesigned for 1973 with new, fresh styling. Overall dimensions are about the same.

Brings Safer (but Longer) Cars

Main attractions are the all-new Chevelle, Le Mans, Skylark, Olds F-85 and Cutlass, with plenty of news across the board

By **JIM DUNNE** / *PS Detroit Editor*

For Detroit, 1973 will be known as the "Year of the Bumper." At General Motors, 1973 will also be remembered for the introduction of a new concept that combines safety innovations and sensational styling in one package. For buyers, the 1973 models should bear a "made in Washington" stamp because of the great influence federal standards have had on the new cars.

Whatever your viewpoint, the new models still have a good measure of the cosmetic ingredients that excite the impulse buyer and, at the same time, engage the interests of the practical customer. There are changes aplenty.

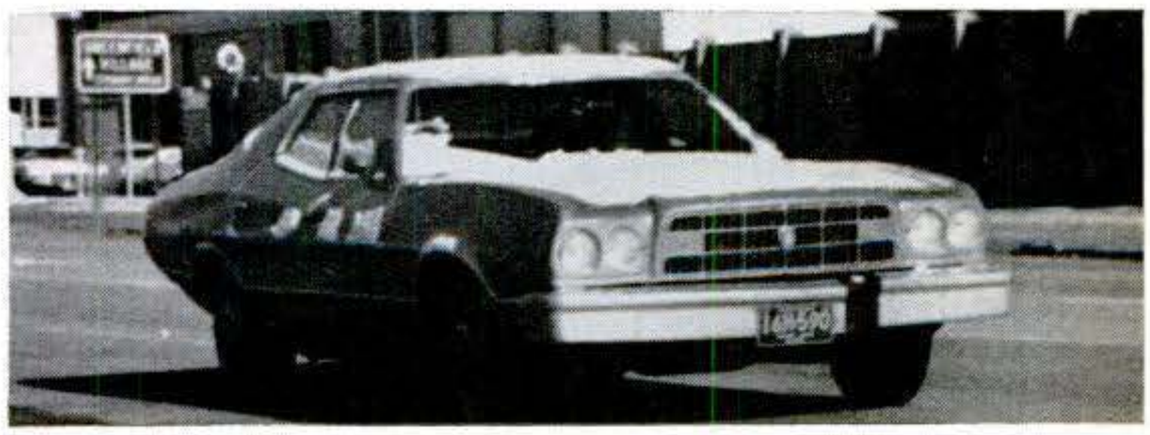
Almost without exception the new cars will be longer, as much as four inches on some models, as a result of the changes in bumper styling. Bumpers have been moved out from the body to allow some room for absorbing the shock of collision.

By government decree, all the new cars must withstand a five-mph barrier crash in the front and a 2½-mph impact in the rear without damage to any safety-related items such as lights, steering systems, or windshields. Translating a barrier crash into car-to-car terms, you can theoretically ram one 1973 car into another head-on at 10 mph without causing any damage to either. In addition, the bumpers must return to their original position automatically after impact so they can again be crashed without damage.

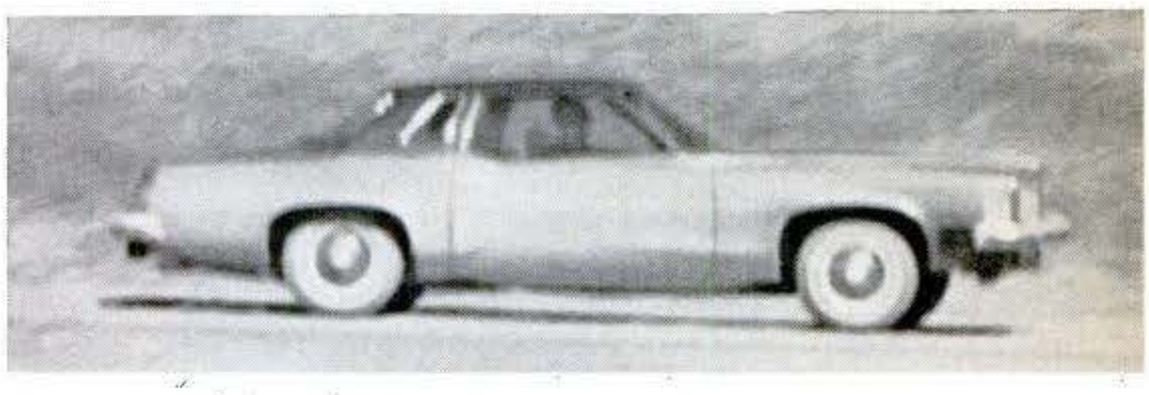
Three major systems are used to provide the bumper with the "cushion" necessary to absorb the impact: telescoping shock absorbers filled with a fluid plastic; molded-rubber pucks that stretch, then return to their original shape; and spring-steel bumper supports not unlike the kind you see on cars of the 1920s.

Most of the new-model excitement will be generated by GM. The GM intermediate lines—originally scheduled for last year—have engineering changes and new styling that will start an industry trend in coming years. New top-line intermediates will be introduced by Chevy,

[*Continued on page 118*]



FORD TORINO grille and front end have been redesigned to match new bumper structure and backup system required by law.



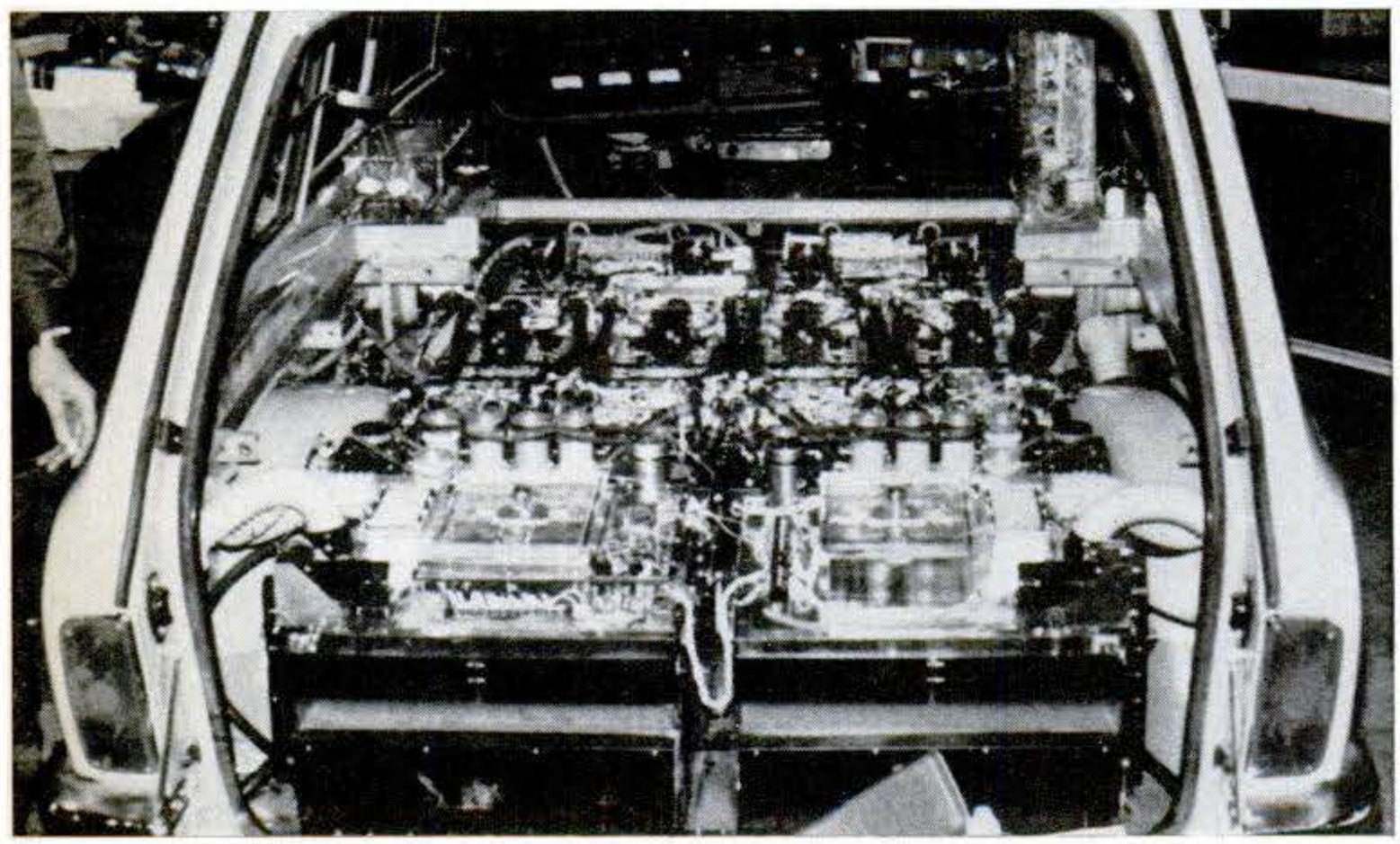
PONTIAC GRAND PRIX has typical Pontiac nose, shares the Monte Carlo roof, while chassis is basically Le Mans.

FORD THUNDERBIRD has few changes because the '72 model was all-new. Bumper is missing from this pre-production car.

GM INTERMEDIATE of unidentified make shares Chevelle side panels but differs in roofline. It could be a Le Mans.

Copyrighted material

Riding rear baggage area of experimental Subaru Electrowagon X-1 is new six-kw zinc-air fuel battery. Under front hood is a 10-kw ni-cad secondary battery.



New Fill-'er-Up Battery Delivers Jolt to Electric Cars

By JIM DAVIS

Refuelable, 6-kw zinc-air battery—backed with ni-cad booster—eliminates recharging delays

What's holding up development of a practical electric car? In a word: power.

Fuel cells are one possibility. They produce enough electrical energy and offer good performance between fuelings, but require high temperatures or exotic fuels.

Batteries offer promise, too. But the problem here is energy density—designers haven't been able to jam enough kilowatt hours (kwh) under the hood to permit reasonably extended driving. Lead-acid batteries, for example, have a maximum energy density of about 10 watt-hours per pound. Besides, recharging takes too long.

A new density high. Now, the Sony Corp. may have found the answer. With a recently demonstrated experimental battery, a Sony prototype car with front-wheel electric-motor drive can cruise at 25 miles per hour for five hours and reach speeds of more than 56 mph. The battery's energy density is up to 42 watt-hours per pound.

Sony's new power source is a refuelable zinc-air system. Each of the 256 six-by-eight-inch cells in the six-kilowatt battery has two positive porous-carbon air electrodes with a negative electrode sandwiched between them. Separators prevent the electrodes from touching.

Powdered zinc, suspended in an electrolyte, flows into spaces between the positive and negative electrodes. As the liquid floods the cells, zinc particles become trapped on the negative electrodes.

Air from vents seeps through the porous-carbon electrodes, oxidizing the zinc and liberating electrons. The spent zinc particles are flushed from the electrode plates when fresh fuel is added.

The used-up zinc can be recovered by an electrolytic process. Recycling is fairly efficient: Putting one kwh of energy (fresh zinc) back into the battery takes 3.8 kwh of line power.

Refueling is automatic. Cam-operated distributors operate valves to accept and discharge fuel from storage tanks. The "feeding" period lasts eight seconds; a 52-second power-production period follows.

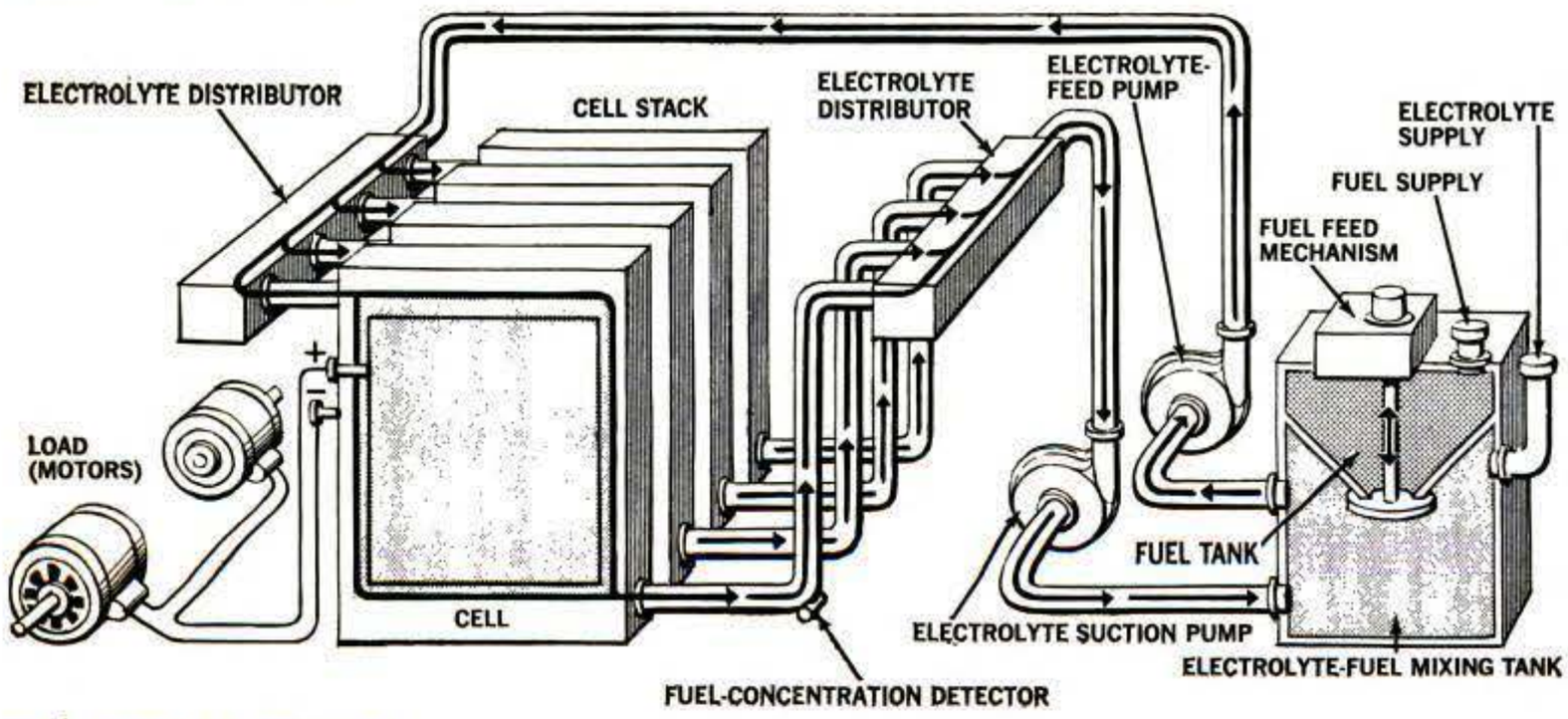
Since some zinc dissolves in the electrolyte during the power cycle, its concentration must be measured after the fuel is discharged from the cells. The zinc concentration detector, linked to the zinc-feed mechanism on the fuel tank, maintains the correct zinc level.

A 10-kilowatt nickel-cadmium booster battery, which can briefly crank out 40 kw, is used for starting, accelerating, and hill climbing. The ni-cad is also used during the fuel-feed cycle, and recharges from the zinc-air battery when the car is operating at steady speed.

Cost is moderate. In fact, Sony says production cost for the battery might run as little as $100 per kilowatt—$600 for batteries with the same power capability as those now used in the prototype car.

Who knows; one day not too far off you may pull your car into the service station and say "fill 'er up"—and take on zinc. PS

How the fuel is mixed and distributed



Copyrighted material

FOR PIPE SMOKERS: Collector's Items You Carve Yourself

By LURA La BARGE

One-of-a-kind pipe is buried inside every rough-cut briar block. Easiest way to find it: with a small motorized cutting tool and a good selection of cutting bits.

With a prebored briar block, a little time, and a comfortable handful of power tool, you can carve a collector's item—a one-of-a-kind pipe—for your favorite pipe smoker, or for your own collection.

Briar isn't something you can pick up at your neighborhood lumberyard, but it's easy to get. The mail-order sources, listed later on, import the best Italian and Corsican briars, prebored for both bowl and stem, and complete with stem. One source supplies a kit including instruction booklet and finishing materials.

The blocks come to you cut roughly to appropriate size and shape (you choose straight- or bent-stem style). Where you go from there is up to you, but before you make any hard-and-fast design decisions, give the whole block a preliminary sanding. This brings out the irregular, burl-like grain pattern and you may decide on a design that complements the grain.

Next step is blocking out the general shape you want. Do this with a pencil directly on the block—both side and front views. Designs can be as free or conventional as you like, but remember: The walls of the finished bowl should be at *least* $\frac{3}{16}''$ thick on the bottom as well as around the sides. With the design blocked out, saw the block to rough shape.

Now comes the fun part—carving. Work with chisels and gouges if you like, but I found a Moto Tool or a flexible shaft the ideal tools for the job. The high-speed bits eliminate the chipping and splitting that you're likely to encounter working the irregular grain with a chisel. Add to that the comfort of carving a hand-held piece of work—something you'd never try with a sharp gouge in your other hand—and the joy of motorized carving becomes apparent.

Start with one of the larger bits. A big bit removes large amounts of wood quickly if you don't force the tool. These bits rely on speed, not heavy pressure, to work best.

Two tricks can help. To get a good grip on the pipe while you carve, leave the stem in the block—it makes a good handle. Insert a dowel of proper size in the bowl of the pipe and you have a handle there, too.

If you're after a random rustic surface like that on the pipe in the photo above, it's easy to get. Just take little closely spaced nips out of the block with a ball-end cutter.

More intricate designs—the two heads at right for example—require more work. After preliminary shaping with a large cutter, start working down to smaller bits, to define the shapes more clearly. Use the smallest tool you can find to put in the fine details.

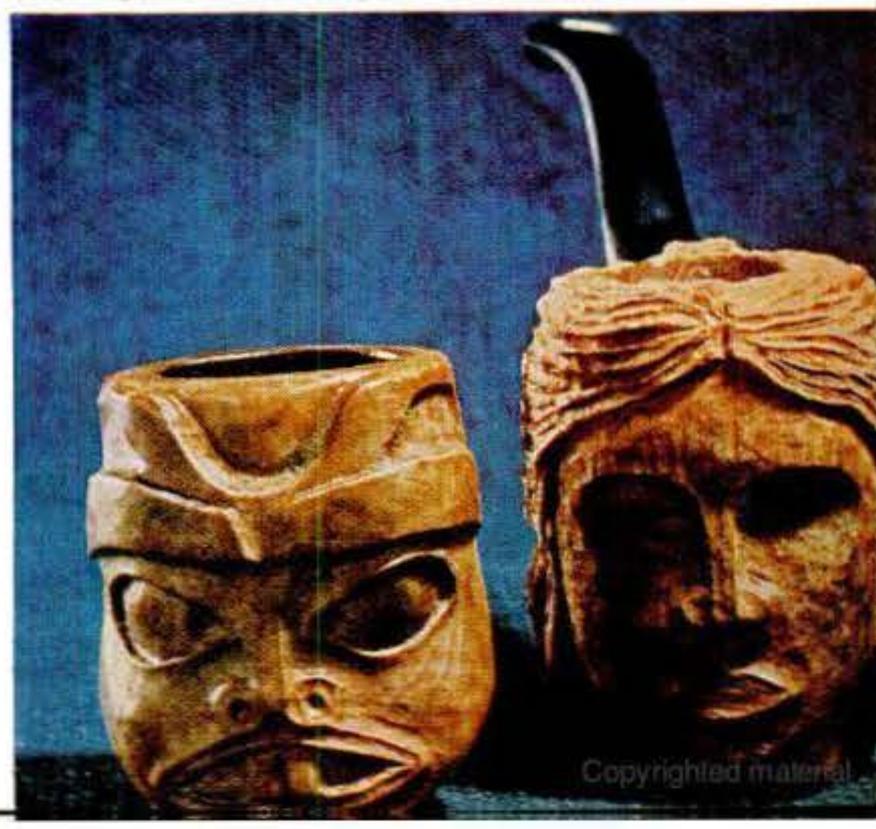
If you're a perfectionist, it's a simple matter to improvise cardboard templates to help keep your design symmetrical. Judge your centerlines from the boring, not from the rough block.

Once the design is carved to your

[Continued on page 120]

You're free to go wild when carving your pipes. Blocks come in straight-stem (two pipes on left) and curved-stem styles.

High polish or rough finish depends on design and wood. Italian briar, left, is from Barclay; Corsican, right, from Hampton.



Copyrighted material

Sails Up for a New Way to Surf

You don't need ocean waves to Windsurf—just wind and water. Now surfing is becoming a coast-to-coast sport

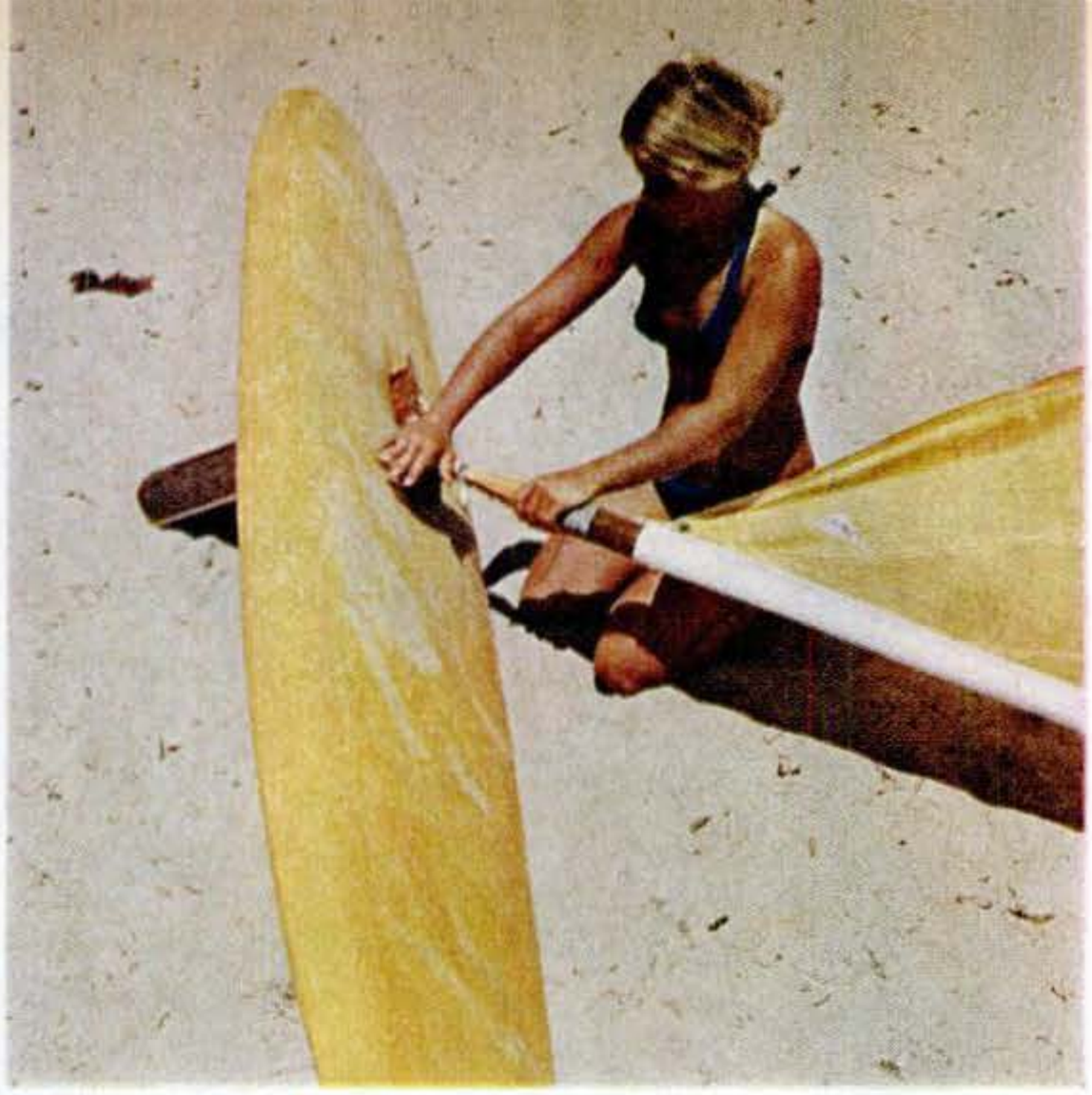
By **JIM DAVIS** / *PS West Coast Editor*

It's a lot like surfing without surf. Or water skiing without a tow boat. Well, maybe it's more like sailing without a place to sit and keep dry. No, Windsurfing is like all three sports combined, and something more. A brand-new sport, it's based almost totally on today's new materials and technology.

Take the hull. It's formed by pouring powdered polyethylene into a hollow mold. Spinning the mold forces the powder equally over the mold's inner surfaces. Add heat, the powder melts. Cool and you have a seamless, hollow hull. Fill the hollow with plastic foam for flotation and extra stiffness; the hull's done. The sail is 65 square feet of Dacron. The mast? Fiberglass—fitted to the hull on a patented universal made of nylon. This pivoting mount is the whole key to Windsurfing. With a fixed mast, the slightest breeze would flip the lightweight hull. But the universal lets you tip, twist, and angle the mast to control your speed and direction—and to remain upright.

Who makes Windsurfers? Windsurfing International, Pacific Palisades, Calif. 90272. Price? $365. PS

Three steps to getting underway are shown in the three photos across the bottom of the page. First get out in the water, lower the centerboard and climb aboard. Leave sail lying flat.



Like a sailboat, the Windsurfer has a centerboard for stability. You can pull it up for clearance in shallow water. A small skeg at the rear of the board (not shown) also adds stability.

Universal joint between mast and hull is the secret of the Windsurfer's success. Without it you'd have no directional control, and the lightweight craft would flip over in a breeze.

Calm waters with low winds are a good place to practice the new sport. An overabundance of wind will just slow the learning process—you'll spend most of your time in the water.

Surfing without surf—that was the original idea behind Windsurfing. Now that the sport is catching on, though, you'll find Windsurfers on the water even when the surf is up.

Grasp the rope leading to the mast, and when you feel comfortable standing on the board, position yourself with your back to the wind. Now pull the sail out of water. It comes up easily.

The sail will hang free or luff in the breeze while you pull it up. Next, grasp the wishbone boom with both hands. Ready? Tilt sail forward, turn it into the wind, and you're off.

INSTANT HOUSING

Build a

Each Microhut provides private living for one or two members of family or group

By KEN ISAACS

Looking for an inexpensive, easily-movable, two-man shelter that can provide private living for members of your family, or for each of several couples sharing a vacation site? My new Microhut could be your answer. It's a great way to build a commune in gradual steps, too.

Of course you can put a solitary unit on your site, but the most exciting use of the new Microhut is the "village" mode. Several modules are loosely grouped in a natural setting to take full advantage of the irregularities of the site. Sun, shade, sweet breezes and view determine unit positions, while the whole complex surrounds a central community area with a picnic table and open fire for cooking or relaxing.

This gives you a miniature settlement of colorful, inexpensive cabins loosely ringing a community space or "village square." Microhuts are light-footed as the Indians were on the land, leaving the ecology relatively undisturbed.

These new lifestyle possibilities opened up by the Microhut are exciting, but so is the structure itself. The shell is of unframed waterproof Douglas Fir plywood only 3/8" thick.

Second-floor sleeping space is revealed when corner of Microhut is removed. Sleeping area is well over seven feet long.

Tetrahedron leg supports get the Microhut up off the ground, where it stays dry and free of insects and pests.

FOR YOUR COUNTRY SITE:

VACATION CLUSTER

It is of stressed-skin construction, with each of the panels forming a hyperbolic paraboloid. This saddle shape is incredibly strong, despite the use of relatively thin plywood. All the components for one unit can be carried easily in the back of an ordinary station wagon.

Inside, you can stand erect in the half of the structure used for entry, cooking, and dressing. You sleep on the horizontal midpoint plane. A table for eating and study is under the sleeping surface and next to a compartment for seating and storage.

The tetrahedral legs result in a broad stable base, whatever the terrain. Minimum site preparation is required. Struts forming these tetrahedrons are designed to knock down easily and compactly for transport.

Putting it together. When you go to the lumberyard for the 3/8" plywood, ask them to saw the panels in half for you. Four-foot-square panels are easier to handle. Make sure you get genuine Douglas Fir waterproof plywood with A-C sides. I use only DFPA-grade trademarked plywood because it stands up best to exposure.

You'll need a protractor, beam compass, and patient care to lay out the panels. Measure one 42 1/4" length on a clean, square unsplintered edge. Mark another 42 1/4" length at 89 degrees from the first edge. Set the beam compass at 39" (length of the two short edges) and strike intersecting arcs with centers at the ends of the two original long edges. Use a good straightedge to draw in the two short sides, and the first panel is complete.

After doublechecking all your work, clamp this master panel on top of two blanks and carefully gang-saw with a portable circular saw. Use the master panel as a template to mark around, then saw all 20 skin panels. Note: To put the good side toward the weather, half of these panels should be reversed. That is, make 10 right (as shown on pattern) and 10 left (mirror image of pattern).

Clamp the skin panels in gangs of six, and lay out 1/4" holes along the edges. You'll bore these holes most accurately by using a drill press or an accessory stand with your portable drill. Distance from the edge should match the holes in the corner angles you buy. Mine were 5/8". Remember that you add 3/16" to this dimension at the mid-side joints where the 89-degree angles join the skin panels to the interior partitions.

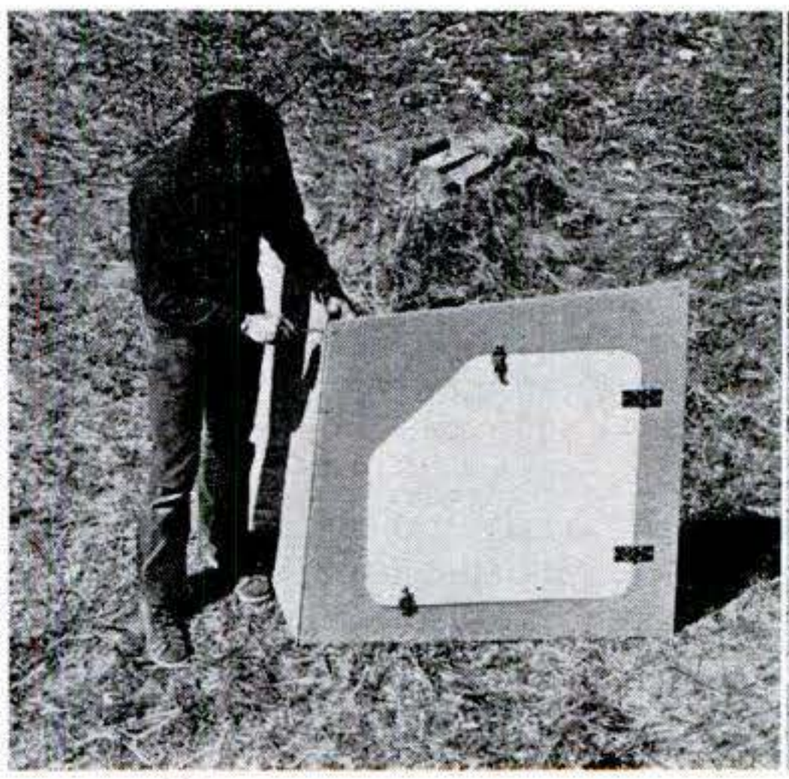
Lay out the window and hatch openings as shown, and cut them out. I used a Sears rotating-head saber saw at fairly high blade speed for a nice, clean job. Pick four panels for the bottom of the shell, lay out and drill the 5/16" holes to mount the tetrahedrons.

Use similar procedures for the interior partitions and floor panels. The "floor-panel support" is slotted together like an eggcrate. Try for an accurate but not binding fit. Openings in the interior panels should be cut individually with the variable-speed saber saw at fairly high speed.

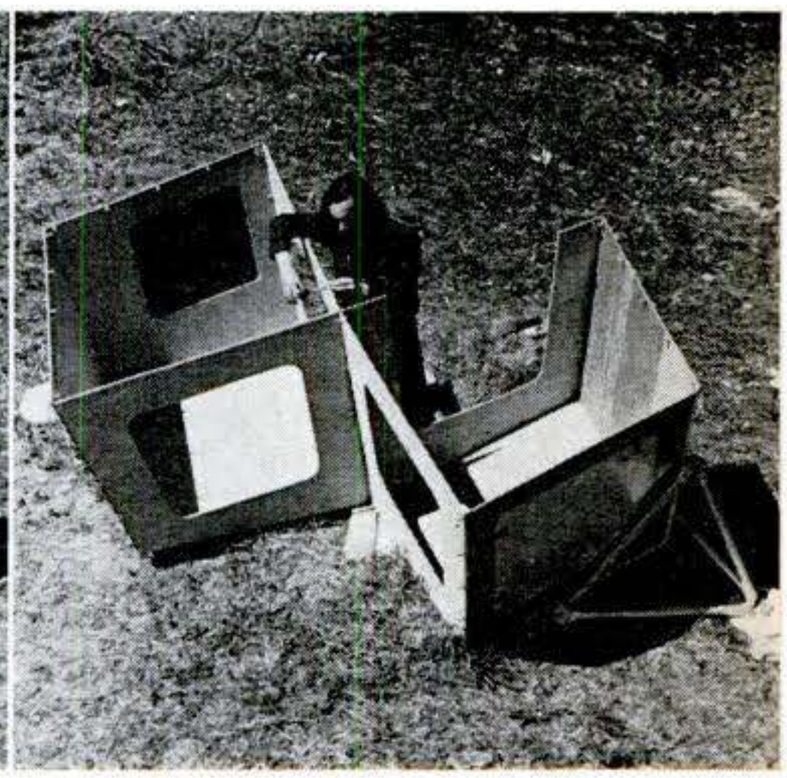
Making the legs. When you buy the plated thin-wall conduit (1 3/4" actual diameter) ask if your electrical supply house has a power hacksaw. The cutting charge will probably be minimum and you'll save a lot of work by having the 24 struts power-cut to length. Ends of struts are carefully squeezed in a heavy vise to form the tabs. Try to hold the dimensions and maintain consistency. Drill the 5/16" joining holes after flattening, then bend tabs to proper angles relative to the long axis of the tube.

The foot pads are 12"-diameter circles of 3/4" Douglas Fir waterproof

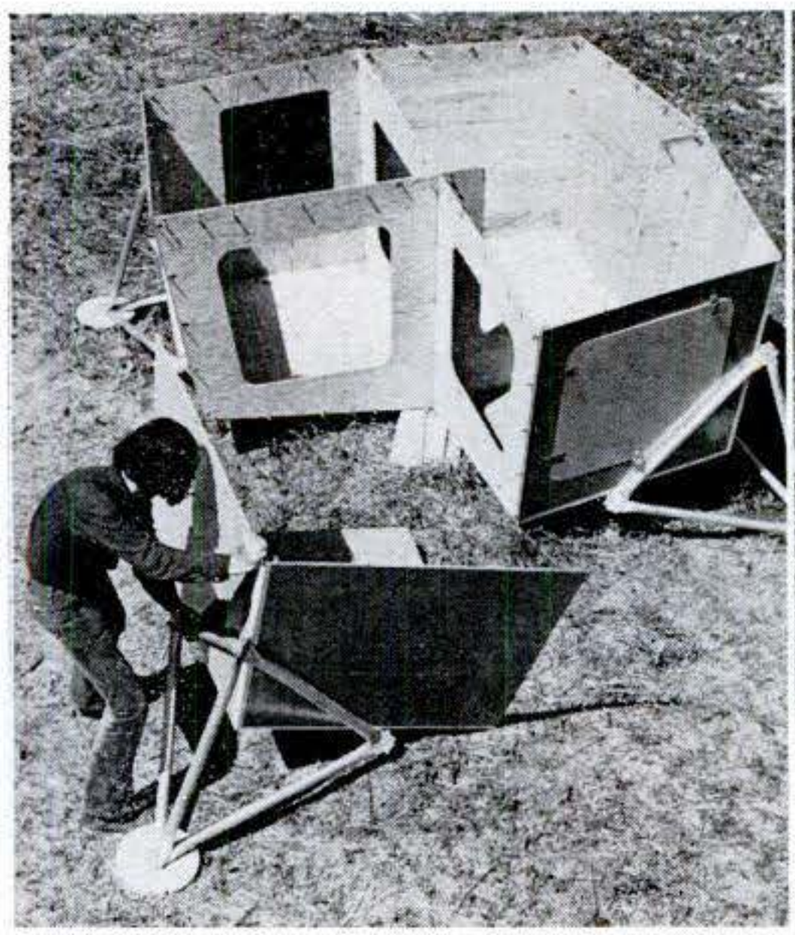
Continued



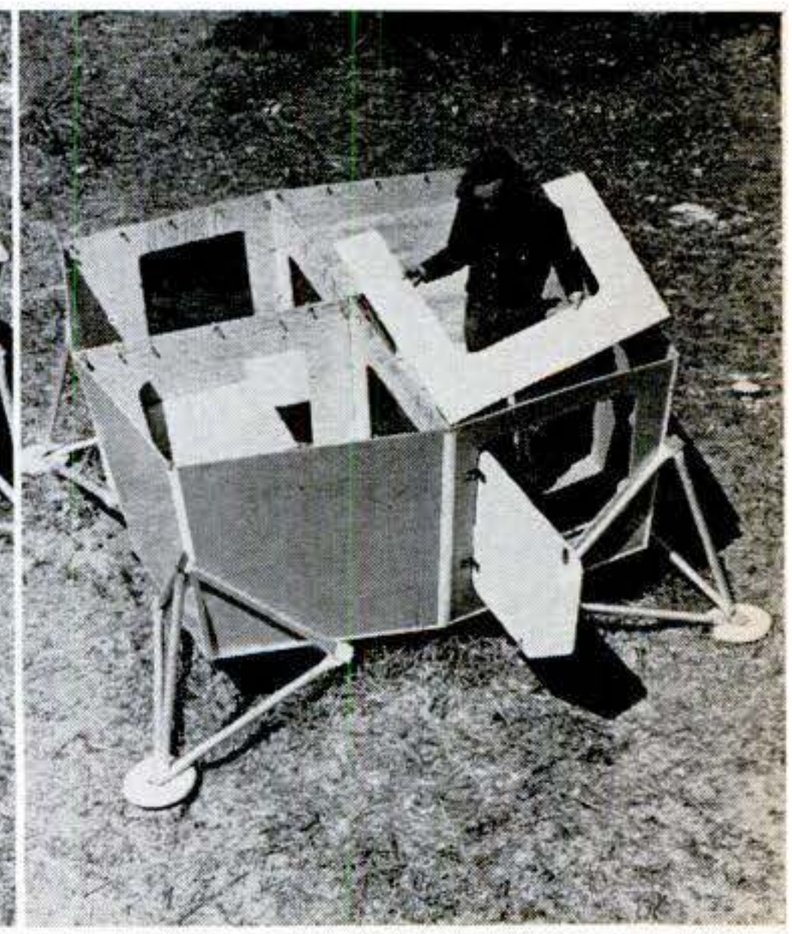
1 Assembly starts when you fasten together a complete lower corner unit—skin, partitions, sealing tape, and leg.



2 Next, fasten together a pair of opposing corner units. Note that sealing tape must be applied before the tetrahedrons.

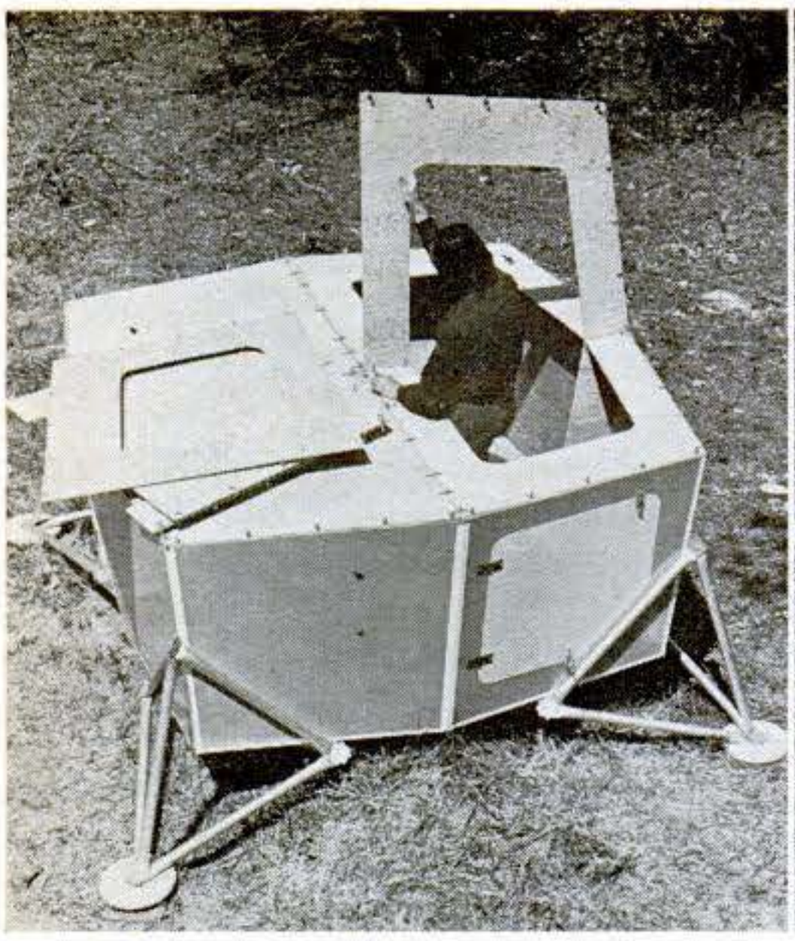


3 Now add the two other lower corner units. You'll have to block up the center of hut until fourth unit is placed.

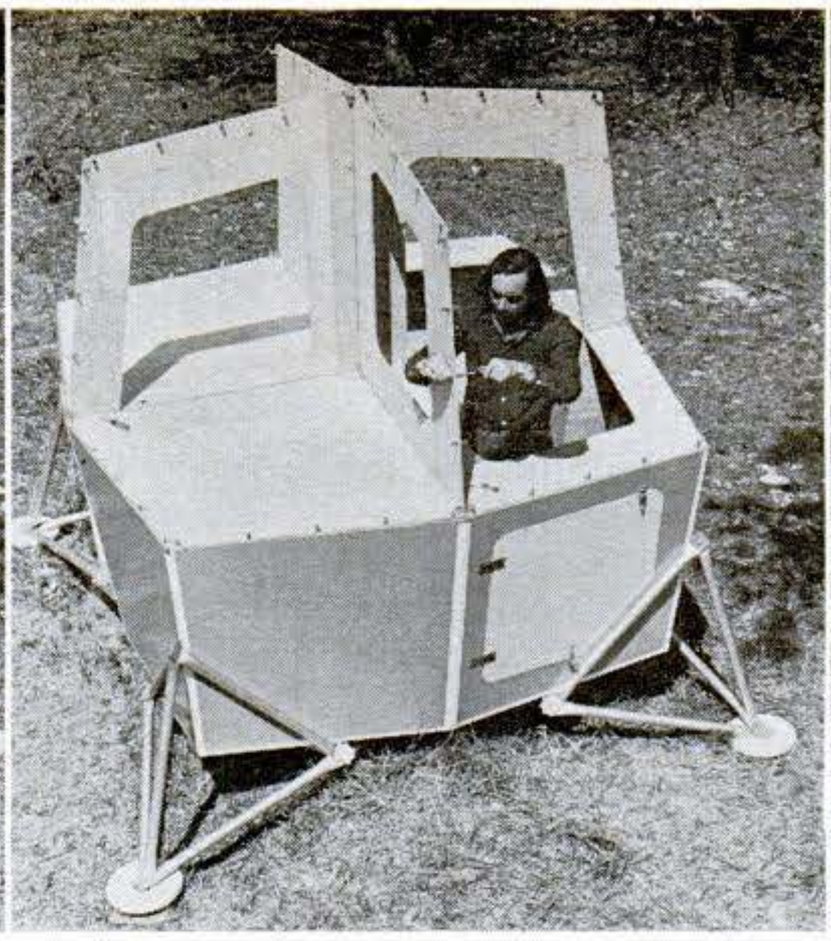


4 Horizontal partitions go in next. As you bolt these in place, be sure to place angle brackets for upper skin and verticals.

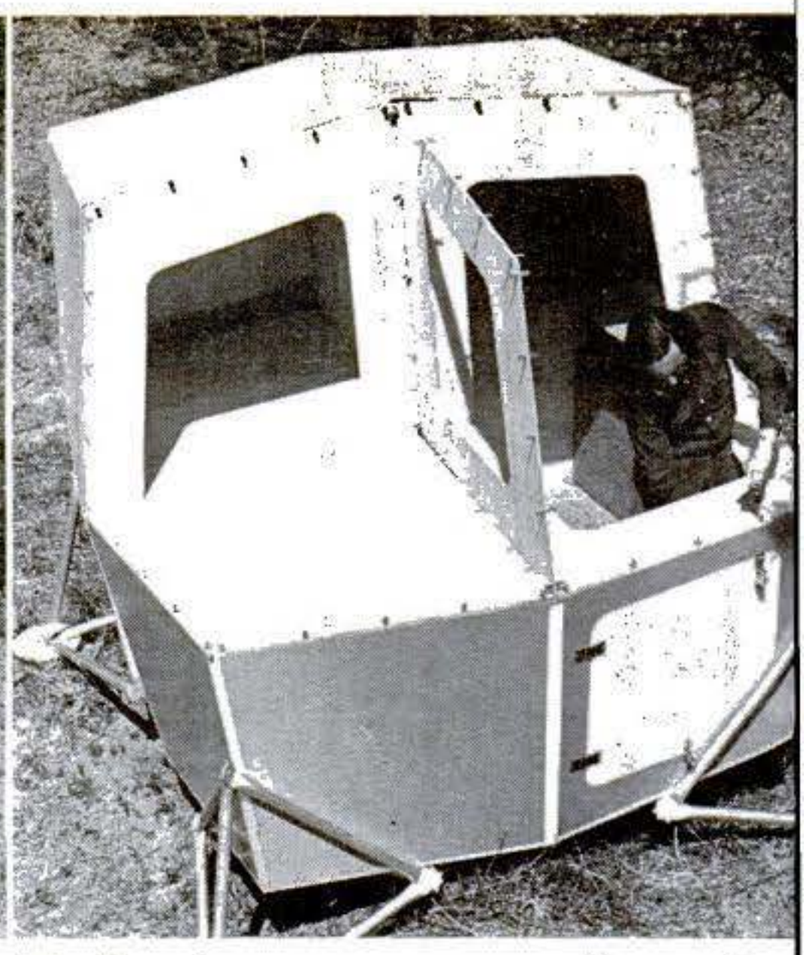
Copyrighted material



5 **Add upstairs partitions** next. Here Isaacs has mounted the partitions to skin brackets before securing partitions.



6 **Four upper partitions** go in like this. Note that the one farthest from hatch is not cut out like the other three.



7 **Now two upper corner units** are in place. Here Isaacs is standing in the half of the Microhut intended for dressing.

plywood. Drill a ¼" hole in the center of each for the mounting bolt, which also joins struts at the outboard end.

To check your work, make a trial assembly of one entire corner of the unit, using three shell panels and three interior panels.

Use a socket wrench to slowly draw the 10-24 x ¾" flathead machine screws until the heads sink flush with the surface of the skin panels. Machine screws as well as conduit look best if they're plated.

When the corner is finished, have a friend hold a tetrahedron in position on the corner of the trial assembly section and drill the mounting holes in the struts through the 5/16" holes in the skin panel.

Windows and hatch. I used a bronze Plexiglas from Rohm and Haas for the windows and cut the blanks to size with a saber saw. To mount the Plexiglas, put the faucet washers under the round bolt heads (this protects the window) and snug up.

Hatch can be cut in the same way, then well sanded on all edges, to provide clearance for opening and closing. You may want to install an adjustable screened roof vent like Sears No. 28K49037 (about $6.50) to provide ventilation for warmer locations, and for cooking.

The finishing touches. Block-sand faces and edges of all panels and parts with #120 aluminum oxide open-coat abrasive paper, and apply a clear resin sealer. The Douglas Fir grain is a fine and beautiful interior finish. Protect it with two coats of the clear sealer.

For the brightly colored exterior, first roll a white enamel undercoat on the skin panels, then roll on the high-gloss exterior enamel. Use a spray can of fine aluminum paint to touch up ends of struts where plating was disturbed in fabrication. Seal Plexiglas windows to skin panels with a bead of clear silicone sealer. After bolting the stop disks inside the door panel, staple plastic roll welting to the door edge as a weather seal. Tape skin-panel joints (I chose 3M Tedlar tape) and your Microhut is finished. Ready to start on another? PS

Mr. Isaacs is presently Assoc. Professor in Design at the College of Architecture, University of Illinois, Circle Center, in Chicago, where he has developed a new Foundaton Course for architects, based on his Matrix Idea. He was assisted in the fabrication and erection of his Microhuts by a select group of students. Microhuts are being produced by Groveland 3 Co-Op, Box 7, Groveland, Ill. They will be available, ready for finishing, for $499 plus crating, FOB Peoria, Ill.

Table is supported across an opening in lower half of hut by means of a clamping beam. Make it from two 33" two-by-twos and a pair of bolts and wingnuts.

MATERIALS LIST

Plywood and lumber
21 sheets ⅜" x 4' x 8' A-C plywood
1 sheet ¾" x 4' x 8' A-C plywood
1 pc. 2" x 2" x 6' fir (table support)

Hardware
510 angle brackets—1" x 1" min.
240 altered to 89 degrees (skin-to-interior)
120 altered 98 degrees (skin-to-skin)
150 angle brackets unaltered (interior-to-interior)
633 10-24 x ¾" flathead machine screws w/nuts and washers (to assemble panels)
48 10-24 x 1" roundhead machine screws w/nuts, washers (to secure windows)
48 neoprene faucet washers (to secure windows)
5 ¼" x 1" flathead machine screws w/nuts and washers (to secure hatch stops)
2 trunk latches w/hardware (for hatch)
2 2" backflap hinges w/hardware (hatch)
12 ¼" x 1½" machine screws w/nuts and washers (to assemble tetrahedron legs)
4 ¼" x 2" machine screws w/nuts and washers (to secure foot pads)
12 ¼" x 2½" machine screws w/nuts and washers (to mount tetrahedrons)
8 pcs. 1¾" x 10' thin-wall conduit

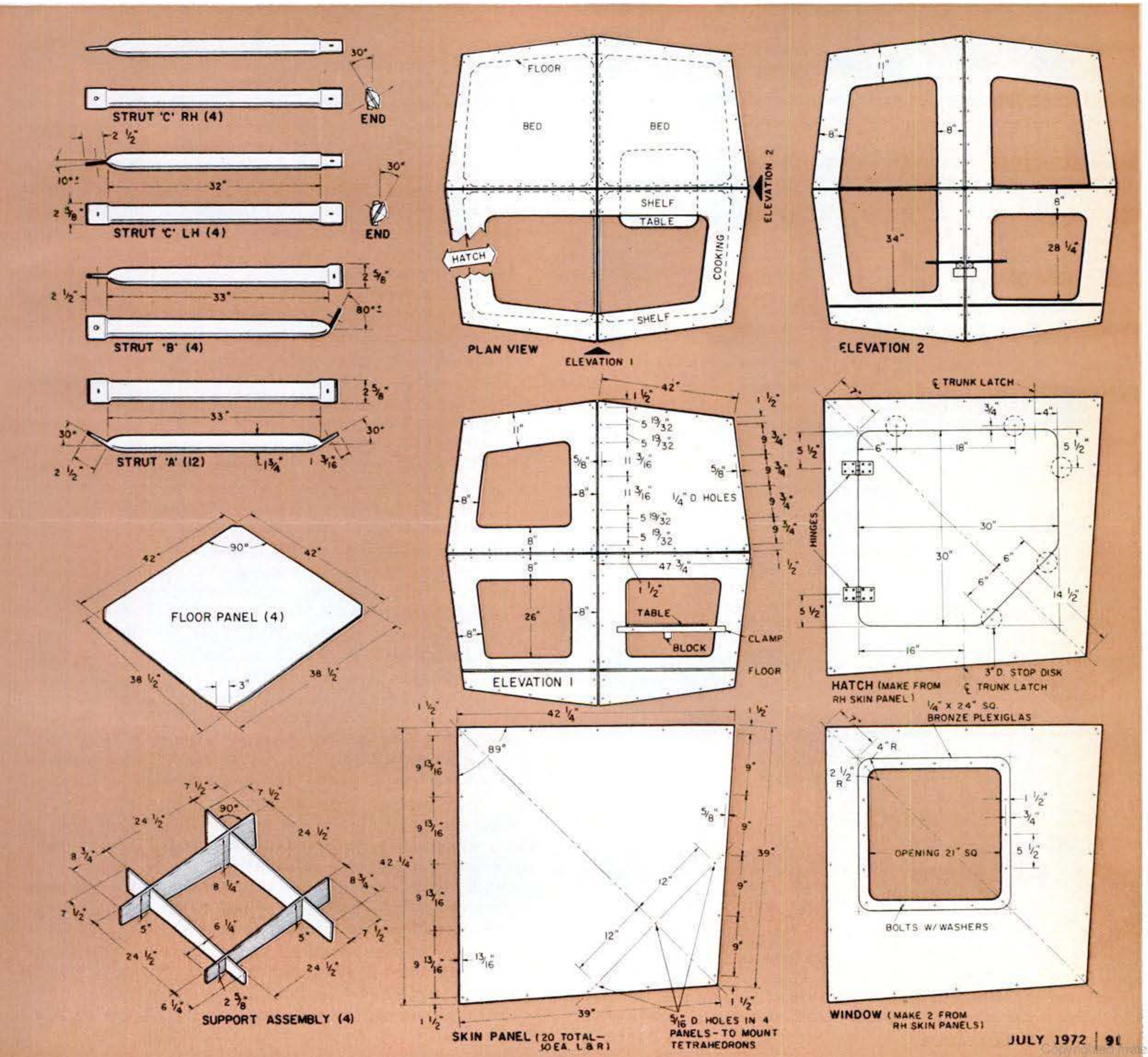
Miscellaneous
Silicone sealer; plastic roll welting; 3M Tedlar tape #Y 9057, 2" wide; 3 pcs. ¼" x 24" x 24" Plexiglas; clear resin wood sealer; enamel.

Copyrighted material

8 **Add a third** upper corner unit and the Microhut is nearly complete. A small socket driver is best tool for assembly.

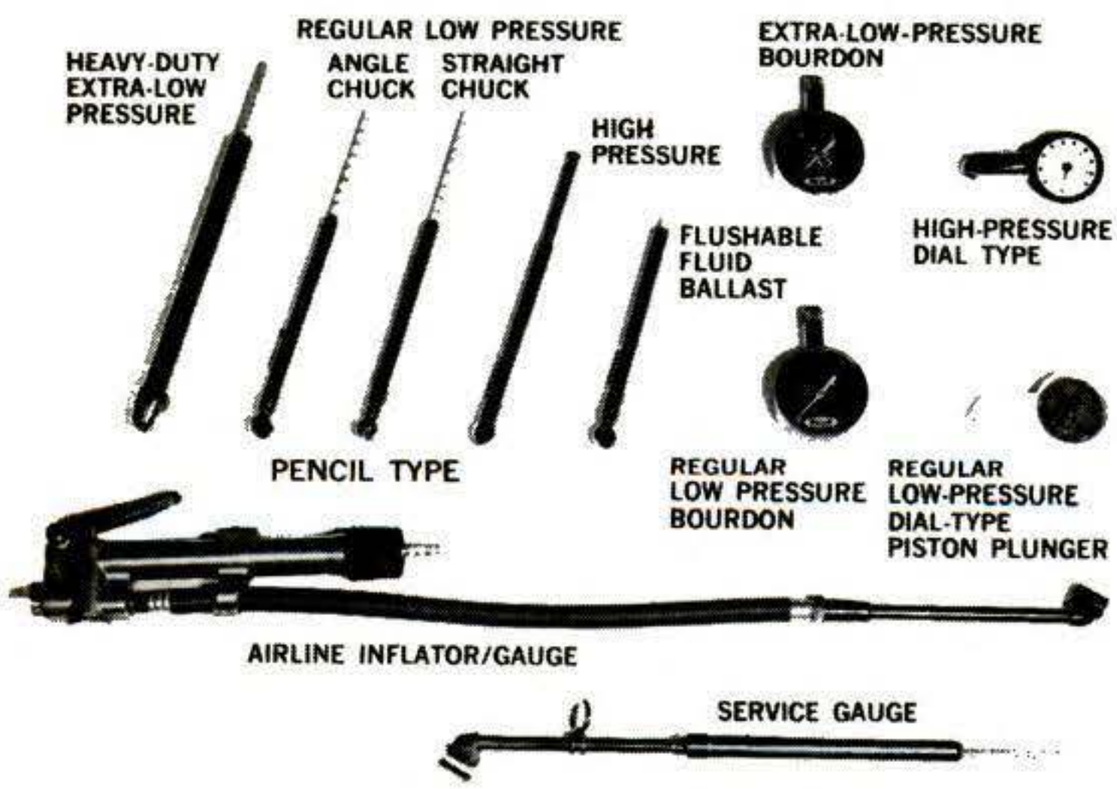
9 **Check to make sure all hardware** is tight as you go along. This assures good skin stressing and maximum strength.

10 **Tape-sealing the seams** comes last. Start at the bottom and work up to achieve a shingling effect where strips lap.

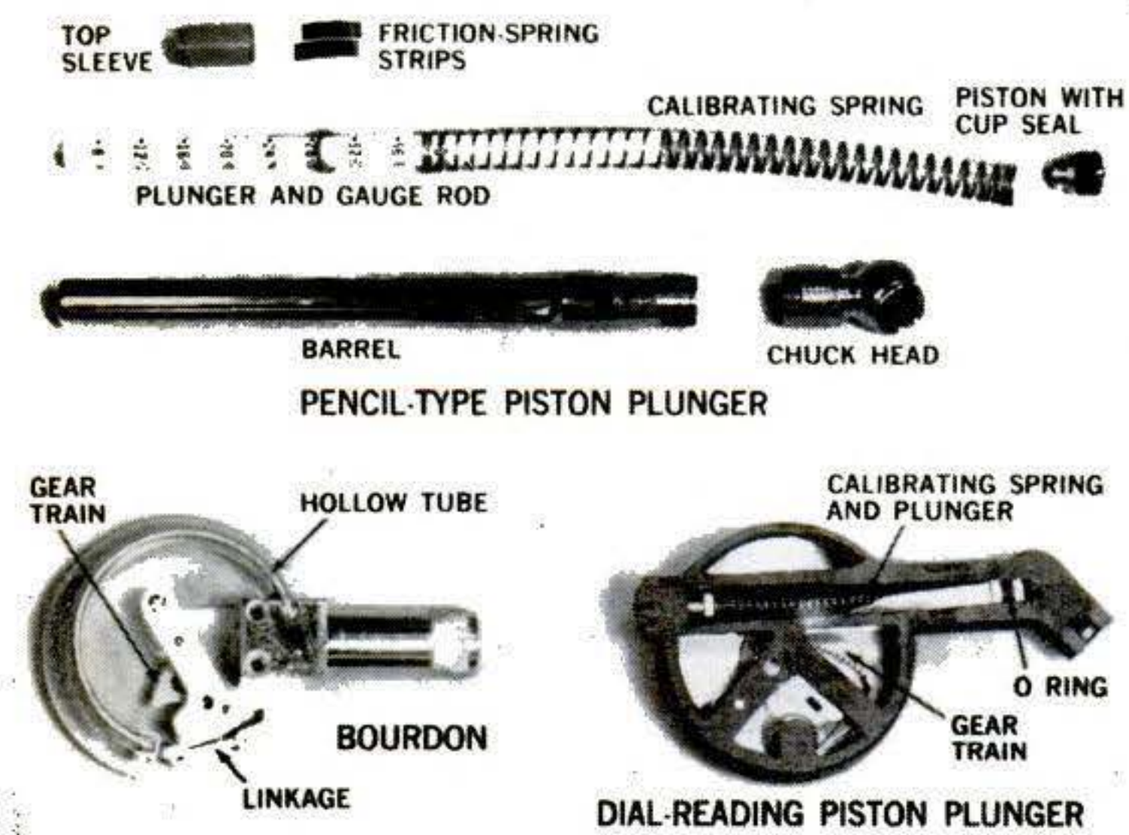


Copyrighted material

There's a tire gauge for every purpose, including this reservoir-type bike-tire pump with a built-in color-coded pressure gauge.



Prices: Pencil-type gauges are $1.50-$7.50; dial types, $1.75-$5; service gauges and airline inflator/gauges, $6.50-$12.



Springs regulate plunger travel in piston-plunger gauges. Curved tube in Bourdon changes shape, moving gear train and dial.

The Truth About

Summer vacation's arrived. You've just packed suitcases, camping equipment, food, toys for the kids, and other gear in your car. First stop: the gas station down the road. You want a tank of high test, and extra tire pressure for the heavy load. Your car manual calls for 26 psi and 32 psi for loaded front and rear tires, so you crank these settings into the station's pump. There are several *ting-tings* for each tire as air is added.

Now you're ready for the road, right? Not quite. Your tire pressure could be dangerously off. National Bureau of Standards tests indicate that about 50 percent of station pumps are three psi off. Some may have a 20-percent error. At minimum, you may be adding unnecessary wear to your tires. At worst, your vacation could be marred by a tire blowout and tragic accident.

Before threading tire caps on, you should always check pressure with an accurate gauge. You can buy a good gauge for under $3, and there are several ways to make sure it is accurate (see box, right).

Different tires need different gauges. Depending on the vehicles you own, you may have to buy several pressure gauges. Why? Part of the trick for getting accurate readings is using a gauge whose range shows the pressure you want at about mid-scale. If there is an inaccuracy problem, it is more likely to be near the ends of the measuring scale. Also, the larger the range, the smaller the spacing between numbers.

A garden tractor may call for four psi in the fat rear tires (ride and traction suffer if this isn't maintained), while a bike with 27-inch sew-up tires may call for 100 psi. Pencil-type piston-plunger gauges for passenger-car tires are accurate to tolerances of plus or minus one pound. Extra-low-pressure gauges are accurate to plus or minus one-half pound, and high-pressure gauges plus or minus two pounds. One manufacturer of Bourdon-tube-type dial gauges specifies two-percent accuracy in the center half of the scale.

Here's a rundown of popular gauge ranges and uses:

- *Extra-low-pressure gauges* (0-15 psi, 1-10 psi, 1-16 psi): Garden-tractor tires; racing tires; air lifts; floats; bag- and barrel-type tires; ATV tires.
- *Regular low-pressure gauges* (4-50 psi, 16-37 psi, 8-64 psi, 12-38 psi, 10-90 psi): Car, lightplane, motorcycle, and light-truck tires.
- *High-pressure gauges* (20-120 psi, 30-130 psi, etc.): Bicycles; trucks; RVs; small trailers.
- *Wide-range gauges* (0-160 psi, etc.): A possible choice where one instrument must do many gauging jobs.
- *Fluid-ballast gauges:* Tractor tires with liquid-ballast solutions such as calcium chloride. These may be corrosion-resistant, flushable pencil gauges or bronze-tube Bourdon-type gauges.

What tire-gauge tests showed. We stacked a number of brand gauges—the kind you'd buy at a reliable auto-supply store—against a Dill certified master gauge, used to check the accuracy of working tire gauges. The tests were made on "cold" tires—at about 70 degrees. Generally, we found, accuracy was within or very near the makers' specified tolerances in the midrange of the gauge scales. But some gauges are difficult to read to a plus or minus one-pound or ½-pound figure.

Piston-plunger gauges, I found, read somewhat high

Copyrighted material

You'll get extra miles on your tires and minimize blowout hazards by learning what gauges to use and how to use them

Tire-Pressure Gauges

By PHIL McCAFFERTY

when heated over 100 degrees F and a little low when cooled to about 10 degrees. If you must store your gauges in extremely hot or cold places, try to stabilize the temperature before taking a reading.

Dropping gauges on a concrete floor isn't recommended, but it didn't seem to affect accuracy if the barrel wasn't bent or dented. One dial-type piston-plunger gauge went blank after one drop; others took more punishment. A Bourdon gauge, generally provided with a protective container, can be ruined if dropped. However, Bourdons withstand internal oil, dirt, and moisture contamination better than piston-plunger gauges.

Here are some things to look for in buying a gauge:

- *Chuck.* Straight and angle chucks are available (see photos). Straight chucks may require shifting the valve position to obtain a reading. Some chucks swivel.
- *Markings.* Check their legibility in poor light. Compare incremental markings on different gauges.
- *Size.* You might want a compact gauge for pocketing or for the glove compartment, and a larger gauge or airline inflator/gauge for home use.
- *Reading hold.* The pointers or bars on some gauges hold the pressure reading until you release a stop button or return the bar—a handy feature.

How to use a tire gauge properly. Whenever possible, take a reading with the tires cold. Pressure specs are based on "cold" tires. This means they have been resting for three hours or more or have been driven slowly for less than a mile. Don't bleed apparently high pressure after tires have warmed up. You can expect about three psi above the recommended cold-tire pressure after driving under 35 mph for a period. After driving at high speeds, the reading will be about five psi high.

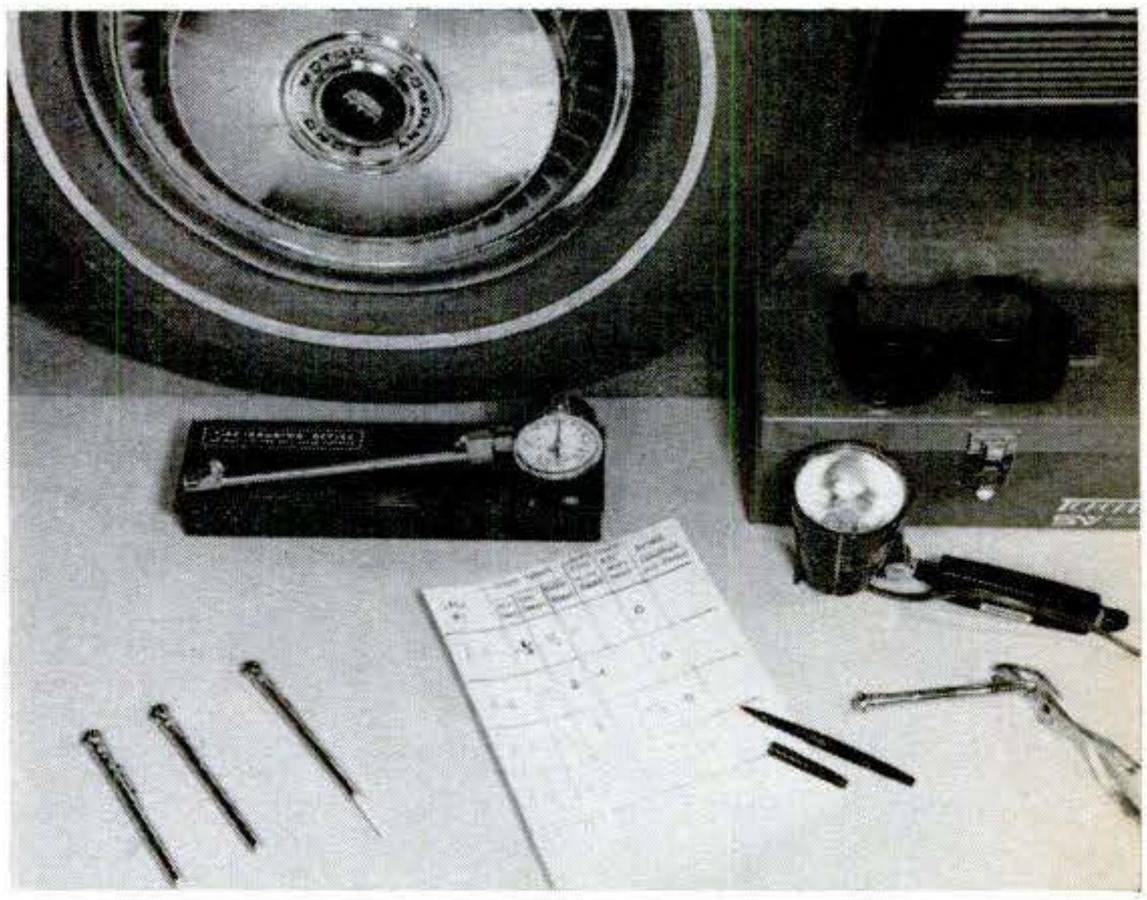
Most tires lose about a pound of pressure per 10 degrees temperature drop. Check your tires when it turns cold after a hot spell. You should check your tires at least twice a month, and always before a long trip.

If a little dirt has accumulated over the valve, release air to clean it out. Push the chuck squarely over the tire valve, but don't jam it on. To insure you are recording maximum pressure, make sure no air is leaking. Don't read the gauge at an angle; recheck to be sure the first reading was actually maximum.

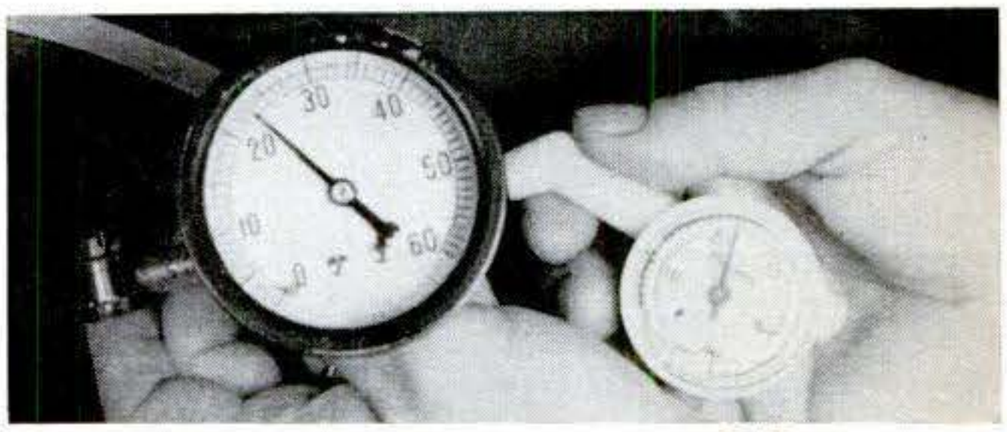
Solving tire problems. To learn how tires react to air-pressure variations and how to "fine-tune" tire pressure to suit your driving needs, see "Tires For Your Car, What Astonishing Differences They Can Make in Ride and Handling" [PS, Apr. '71]. Also, a good annual book on tire specs, size comparisons, ratings, etc. is the *Tire Guide* ($3), published by Tire Guide, 2119 Rte. 110, Farmingdale, N.Y. 11735. A real bargain is the tire-safety kit and booklet from the Tire Safety Council. You get a good pencil-type gauge, four valve caps, and a tread-depth gauge for $1.50. (Send to Tire Safety, Box 726, New York, N.Y. 10010.)

If you own an RV and are unfamiliar with tire facts and specs, you'll find the Council's "Recreational-Vehicle Tire-Care Kit" (a booklet, heavy-duty 120-psi tire gauge, and a set of metal caps) useful. It's $3.50 from Recreation, Box 726, New York, N.Y. 10010.

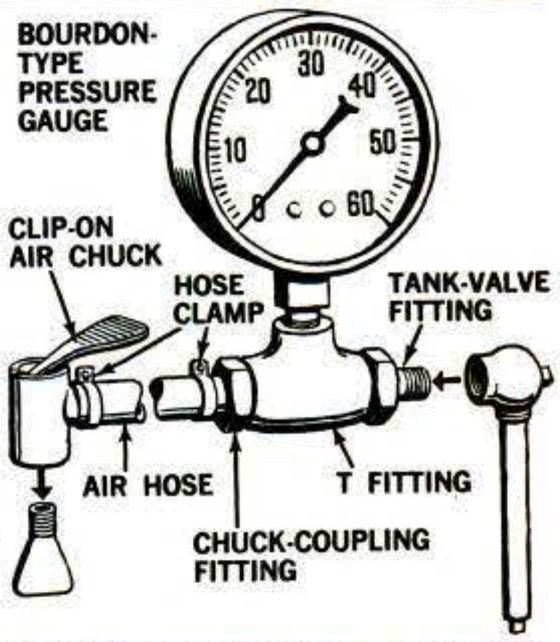
Acquiring an accurate gauge—and learning the fundamentals of tire care—can make your driving safer and add mileage to your tires' life. PS



Bourdon-type master gauge (on box) was used to check variety of gauges. Effect of temperature extremes on accuracy was checked.

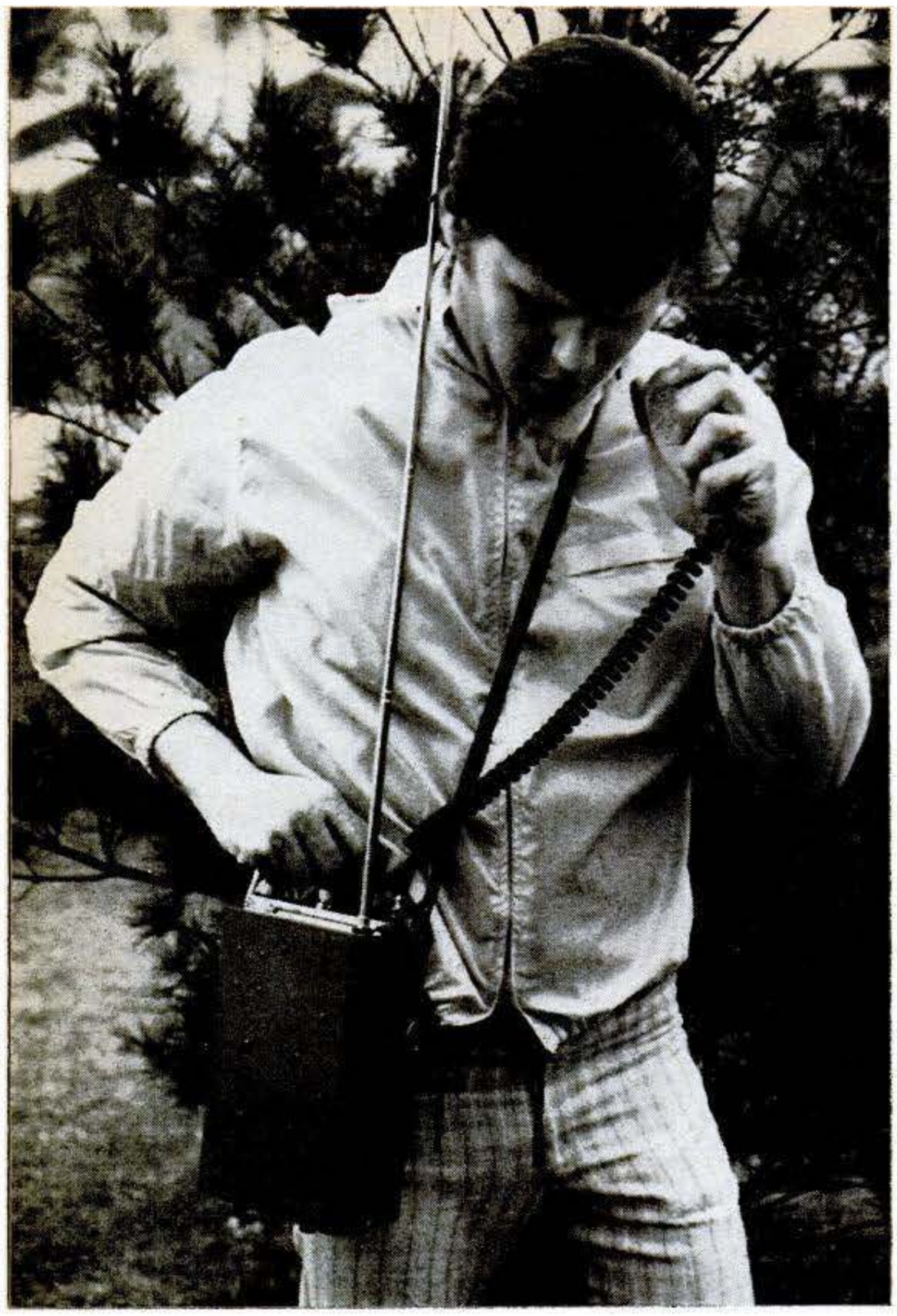


How to keep your gauge honest



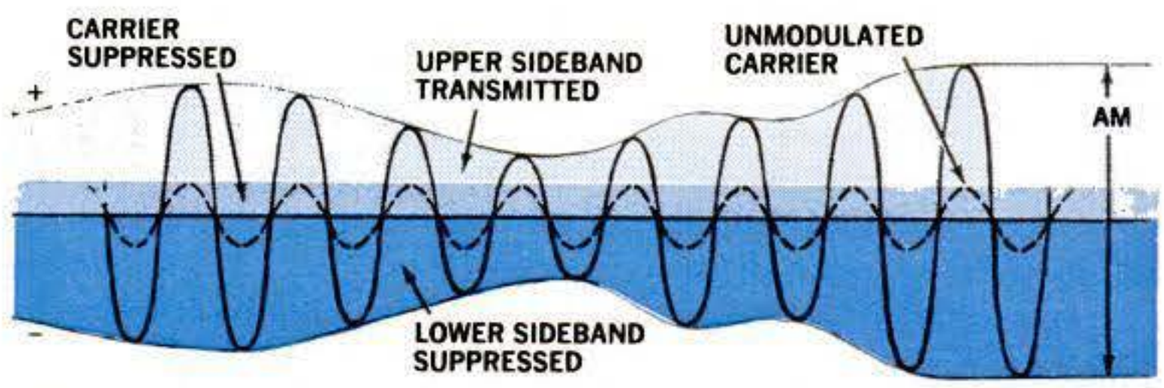
- Check your gauge periodically at a service station or tire store that has a master unit such as the Dill unit described. Recheck to make sure your first reading was actually maximum.
- Buy two identical good-quality gauges from a reliable dealer and check them at the pressure level you will be using. Make sure they give identical readings. Then use only one gauge, keeping the other protected in a drawer as a master for checking.
- Look for a gauge with accuracy and recalibration service guarantee offered. Send it periodically to the manufacturer for checking and recalibration. The usual handling charge is about 50 cents to $1.50.
- Build your own master checking gauge as shown above. Use a fairly large-diameter pressure gauge. Such gauges are available at industrial-supply houses in various pressure ranges with accuracy tolerances of one-half, two percent, etc., for $4 to $5 and up. Cost of other fittings is minimal.

Copyrighted material



Pearce-Simpson's Simba ($430) has it all: digital clock, meters for SWR, RF, and S units, mike preamp, and it's on AM or SSB.

Look What



SSB operation removes most or all of carrier and one sideband.

Lafayette HB-23A ($100) is capable of operating on 23 channels. Optional powerpack ($20) converts mobile unit for field use.

46 new channels, automatic coverage of channel 9, and fewer crystals to buy

By **WILLIAM J. HAWKINS**
PS Electronics Editor

Talk to a ham about CB radio and he may give you a new translation: Clown-Banders. Talk to a CB'er, and he'll praise the day he spent 20 bucks for a license. The gear makers talk about CB as a lucrative business, while the FCC simply doesn't like to talk about it at all.

Everyone has a different slant on citizens'-band radio, but no one can dispute the slant of its membership curve: straight up. And, to meet the demand, CB manufacturers are making new and better equipment that will generally do more, while costing less, and pushing the "legal limit" to the legal extreme.

If you haven't been tuned in over the past two years, then you're in for a change—in set and in rules:

- You can now buy SSB—single sideband—transceivers for CB. What does it mean to you? Better talk power and 46 new channels for you to choose from.
- Crystal synthesis. This electronic technique for simulating 23 pairs of crystals with only a few helps to make the new sets cheaper and smaller.
- Versatility and portability. Special battery packs let you sling some units over your shoulder for outdoor stalking while talking.
- Emergency channel. The FCC has made mandatory what many CB'ers had already put in motion. Channel 9 is now an emergency channel only.

What's an emergency? Anything that can endanger life or property, says the FCC. This includes getting road directions, or information on the local hotels, or, in fact, just about anything else helpful to travelers. Good ruling? You bet, and the FCC should be applauded.

Channel-9 orientation. CB manufacturers have added this feature to some of their units. The Messenger 323-M, for example, contains all the components of a standard transceiver, but squeezed in on the already-loaded circuit board is a completely separate second receiver. While you're talking to your mobile on channel 7, say, the receiver is monitoring 9. Emergency call? The unit either lights an alert lamp or automatically switches you to channel 9.

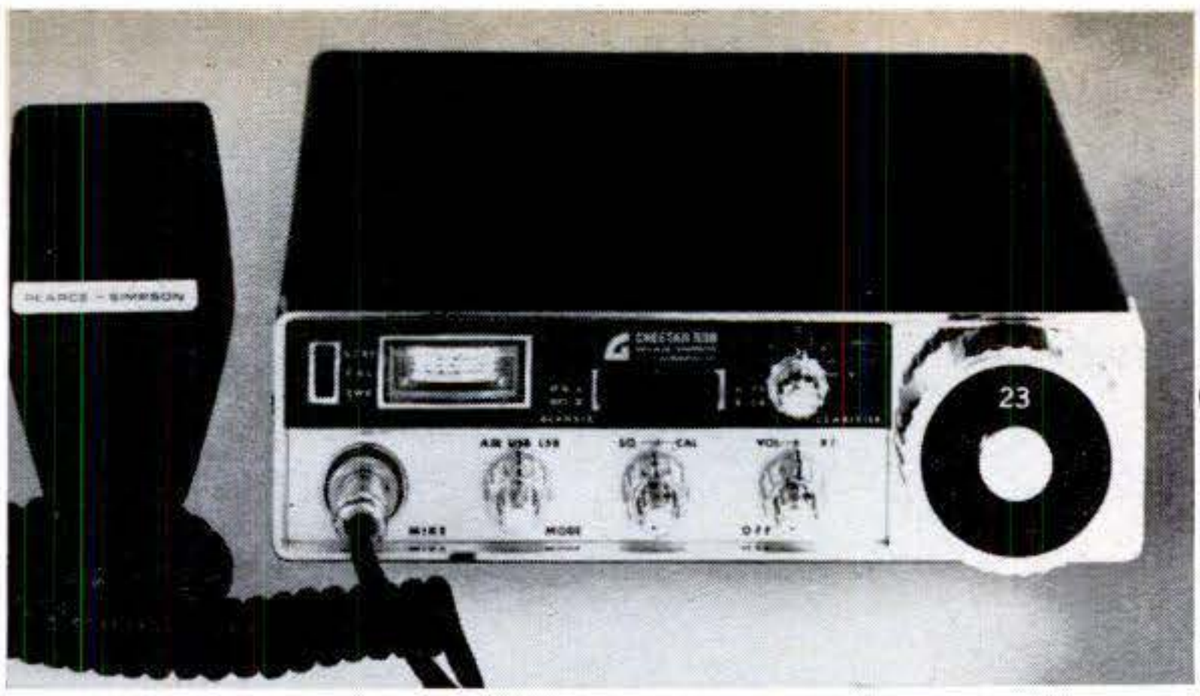
Other units, such as the Cobra by Dynascan, use a scanning technique. Electronically, the receiver quickly switches from the channel you're on to 9 and back (during receive only). If it catches a transmission on 9, the electronic switch stops and you receive the incoming call.

These are two main ways of achieving the same goal. Perhaps the idea will be standard on most sets of the future. After all, what good is an emergency channel if no one is there to listen?

Single sideband. This is a fairly new term in the CB vocabulary, although there's nothing *legally* new, according to the FCC—SSB operation has always been allowed on citizen's-band frequencies. What's the difference between SSB and standard AM? The drawing above represents three states of transmission: unmodulated carrier, amplitude modulation (AM), and SSB.

Pressing the transmit button on a conventional CB set produces a carrier, but with no voice (unmodulated). As you speak, however, the amplitude, or height of the carrier wave, proportionately changes. It not only changes in a positive direction (above the zero line), but an

Copyrighted material



The Cheetah by Pearce-Simpson ($340) is a condensed version of the Simba. Mobile unit works SSB or AM and contains S/RF meter.

Mobile SSB from Lafayette—the SSB-50 ($310)—gives you an S/RF meter, PA-system capability, and built-in burglar-alarm circuit.

They've Packed Into Those New CB Radios!

equal amount of energy produces the same changes in a negative direction. In other words, both an upper and a lower sideband, containing identical information, are transmitted.

Since both the positive and negative changes represent your voice, only one is necessary; the other simply wastes power and band space. Thus: single sideband. In an SSB transmitter, as in, say, the Simba by Pearce-Simpson, one of these bands along with the carrier is removed by a series of special filters or by a phase-canceling technique. You're left with the transmission of either an upper or a lower sideband.

What this means to you as a CB'er is that you now can transmit on two channels where originally you had just one. And, since just one band is generated, your transmitter will technically have an easier time producing a higher peak power output, making copy just a bit better.

Crystal synthesis. Whether you transmit on SSB or in AM, you are still transmitting on a particular frequency. Ordinarily, you would need 46 crystals for all 23 transmit and receive positions.

The synthesis method uses crystals, too, but not merely one at a time. Just as you would mix shades of dyes to make a totally new color, crystal synthesis uses combinations of certain crystals to derive one particular frequency. By changing combinations, and not just individual crystals, any one of the 23 channel frequencies can be obtained.

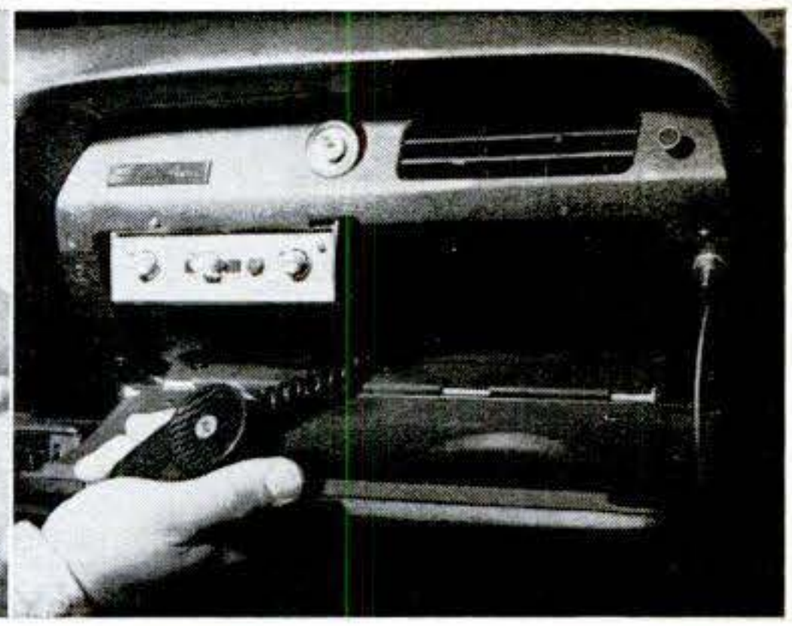
Because of this, units can be designed using only about one-third the usual number of crystals, so they're smaller and less expensive. And, because most of them come with all the crystals necessary to produce all 23 channels, you won't have to buy extra crystals later.

With all that's good about synthesizing, how come it wasn't done from the beginning? Difficulties loomed for the manufacturer who must answer to the FCC for anything basically wrong with his product.

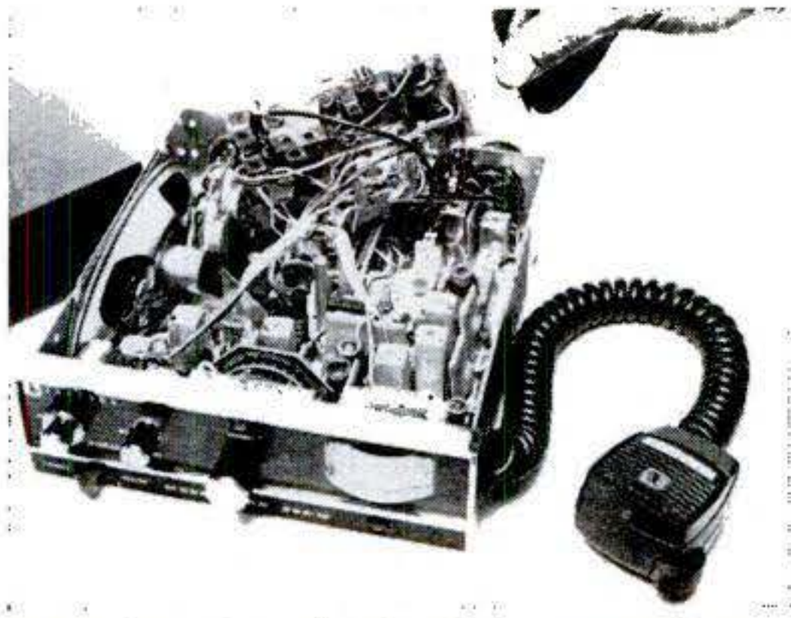
Since synthesis adds together crystals of specific tolerances, you must add up the tolerances as well. Unless the crystals are of extremely high quality, this addition could throw the

[Continued on page 127]

Slide switches on a black faceplate give high-style look to this Classic II. It's a 23-channel AM unit from Courier. ($200).



Mini 23 ($100) from Radio Shack lives up to its name. It operates on 23 channels and makes a small glove box seem huge.



Second receiver chassis of this 323-M from Johnson Messenger ($290) fits neatly into already loaded 23-channel transceiver.

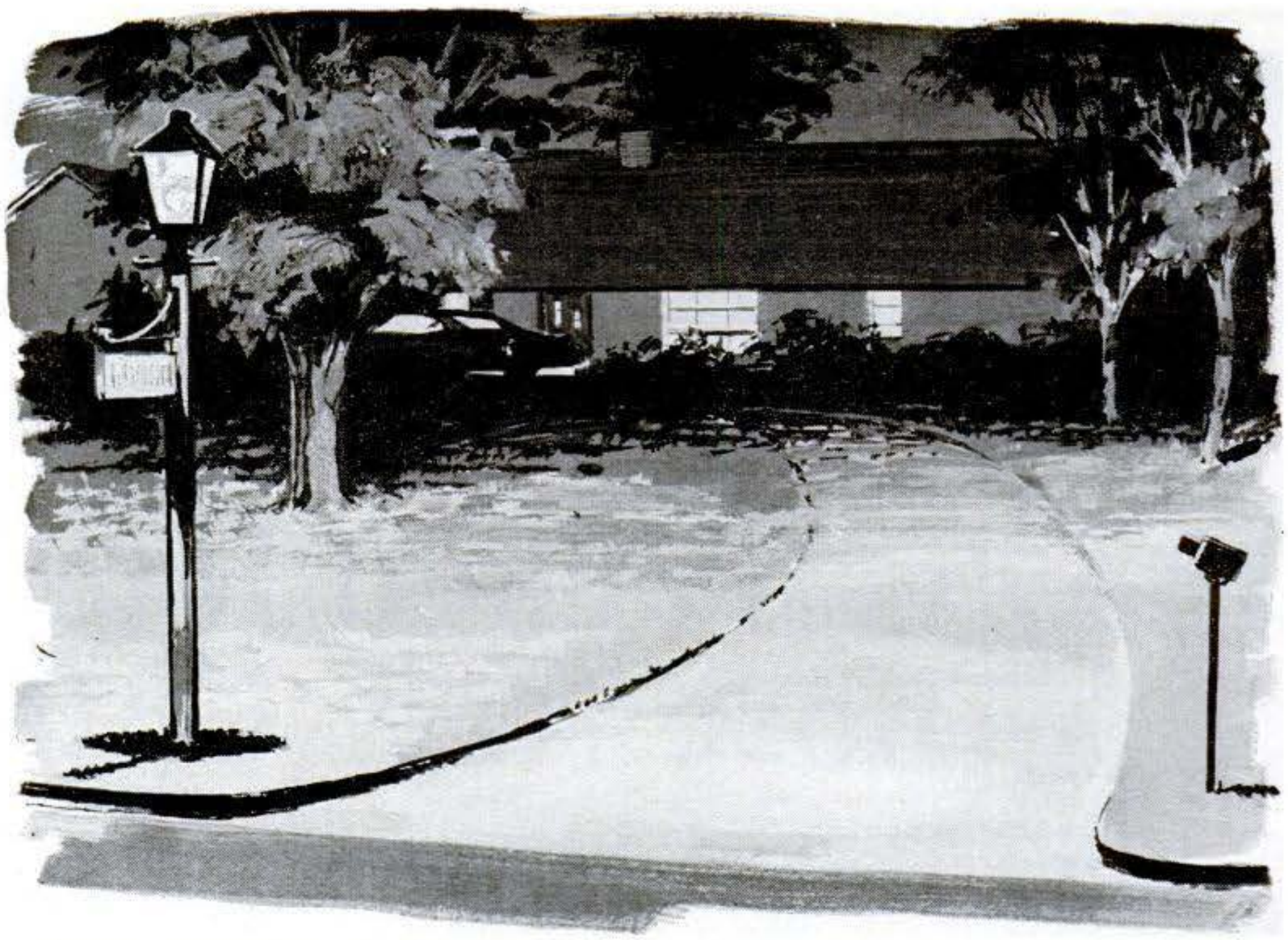
Dynascan's Cobra 28 ($180) uses only one receiver, but electronically switches from any of 23 channels back to channel 9.

Copyrighted material

Foolproof Guard Keeps

Uses AC light only—needs no special light source, and works in daylight, too

By RONALD M. BENREY



Driveway annunciator will ring the doorbell or just alert you to the arrival of guests.

Here's a classic electronic gadget that's been brought up to date . . . and given an exciting new twist. It's a photocell relay—or "electric eye"—that's so incredibly sensitive it doesn't require the separate light-beam source used by conventional electric eyes.

Just point its light-sensitive photocell at any AC-powered light source within about 12 or 15 feet—a table lamp, ceiling fixture, street light, even a night light—and adjust the sensitivity control. Anything passing between the source and the photocell will close a set of relay contacts. You can hook up the contacts to ring a bell, sound a buzzer, or light a warning light.

Note that the light source is powered by *AC*. The eye's circuitry is designed to respond only to alternating light sources: It ignores steady light beams and sources such as flashlights and daylight. Even though your eye sees a steady glow, AC-powered light sources actually flicker 120 times each second, in step with 60 positive and 60 negative voltage peaks of your line current.

Selective and sensitive. The photocell relay's sensitive amplifier circuitry responds to this 120-cycle flicker—and this is the reason for its amazing sensitivity.

Essentially, once the gadget is locked on an AC-powered light source, it ignores steady ambient light (although extremely bright light directed right at the photocell can blind it). Thus, changes in ambient light—the difference between night and day—won't affect the circuit. Because of this, circuit sensitivity can be boosted to make the circuit respond to a tiny AC-powered light source.

By contrast, a small light source can't be used with conventional photorelays, since these *are* sensitive to ambient light shifts. Bright ambient light would swamp out the light source. Thus, such a relay would not operate even if someone interrupted the source's light beam.

The topnotch performance of this device makes possible a wide range of applications you may not have thought of. Here's just a sampling of ideas:

- Burglar-alarm sensor. Connected to any conventional burglar alarm, the cell can monitor hallways, doorways, entire rooms, and hard-to-check areas such as sliding glass doors.
- Outdoor path monitor. The gadget will work outdoors with a post-mounted lamp or small street-light fixture as the light source.
- Driveway annunciator. Use across a driveway, with a post-mounted lamp for the light source as shown above, to signal the passage or arrival of cars.
- Car-near-wall warning in garage. Mount sensor on one side of garage near rear wall; mount small lamp on other side. The gadget will signal when car is correct distance from rear wall as you drive in.
- Electric-light bill saver. Use a pilot light as the signal device and it will light whenever the lights in a room are left on—but it will ignore daylight flooding the room.

It won't take much imagination to come up with applications or variations of your own. For example, connecting your automatic garage door to the car-near-wall warning system can prevent the door from inadvertently being closed on the car. You'll think of plenty more.

How it works. A cadmium-sulfide photocell—a light-sensitive resistor—is the device's eye. The cell's electric resistance changes with the light intensity on its surface. The brighter the light, the lower the cell's electrical resistance.

In this circuit, the photocell is wired in series with resistor R1 and the power supply. When the cell looks at an alternating light source, a small corresponding alternating voltage is produced across R1. Capacitor C1 then passes this voltage to the integrated circuit IC, which amplifies the signal. *But*, non-alternating voltage changes, caused by shifts in ambient light, won't be passed by C1 to the amplifier.

The output of IC is applied to the *base* terminal of transistor Q, which in turn activates relay K. Thus, K's contacts will be pulled in whenever PC sees an alternating light source.

The relay's normally closed contacts are used to control the signal device. When the light source is interrupted, the relay is allowed to open and these contacts close.

Construction. Nearly all the circuit components mount on a small piece of perforated phenolic chassis board that fits nicely within a 7"-by-5"-by-3" aluminum minibox. Use push-in terminals as wiring and soldering points. Handle the integrated circuit carefully. Try not to overheat its leads when you solder them in place, and watch for short circuits between adjacent leads.

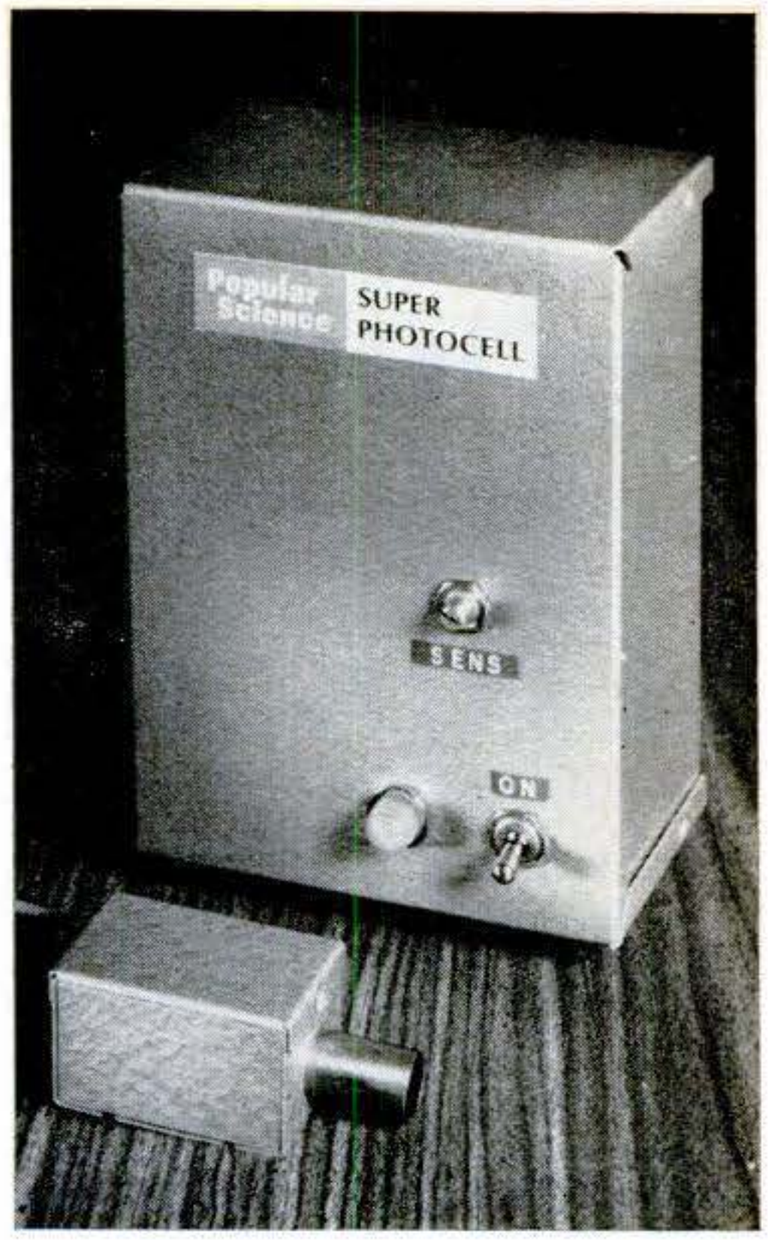
The photocell sensor. Start by cutting a 2"-long piece of ½"-i.d. hard copper plumbing pipe. Epoxy the photocell into one end of the tube.

[Continued on page 127]

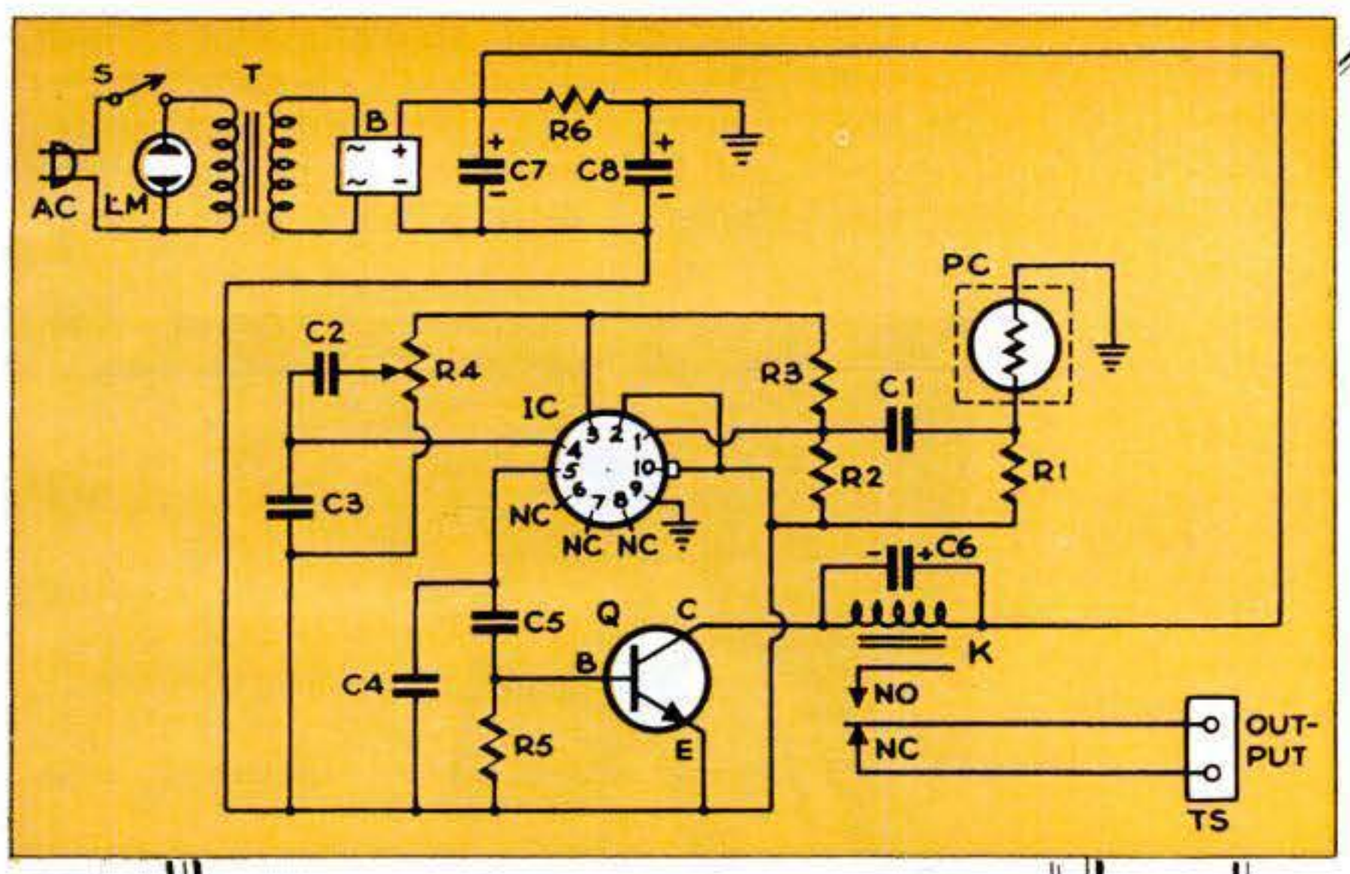
Copyrighted material

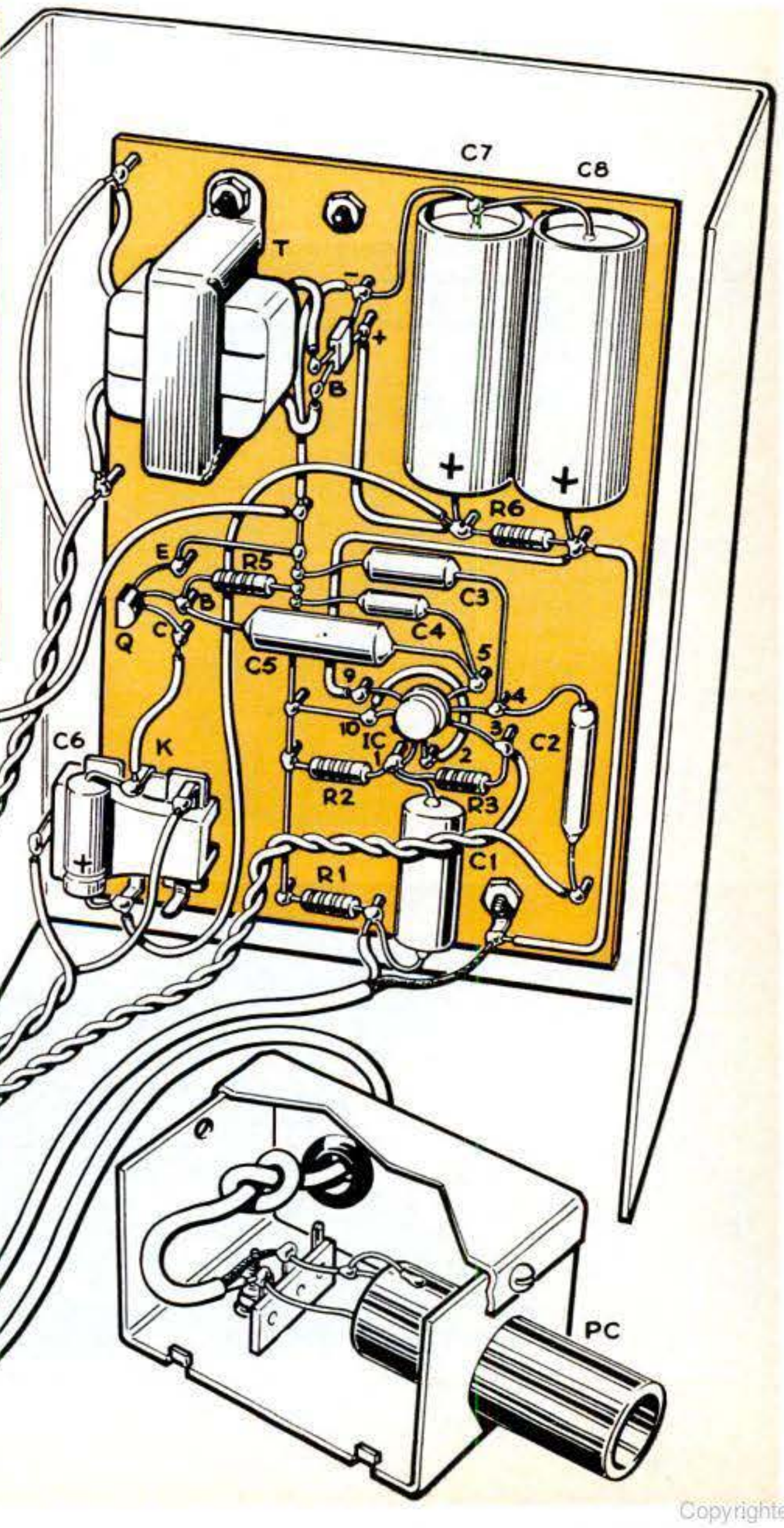
an Eye on Your Home

Another type of "guest-arrival" warning system uses an inconspicuous night light only.



Two units make up the entire system. Smaller of the two, containing only the cadmium sulphide photocell, is compact enough to mount out of sight if desired.





Copyrighted material

For your car, boat, and camper—

Choosing and Using a Fire Extinguisher

If you can afford a motor vehicle or a boat, you can't afford not to have a portable fire extinguisher nearby

By RAY HILL

Engine fire? Grab that extinguisher. If the hood's too hot to touch, use your jacket, shirt, or gloves to protect your hands.

You're driving along the road. Suddenly smoke begins seeping out from under the hood. The engine's on fire! You slam on the brakes and pull off the road. Running outside, you jerk open the hood, and flame roars up from the carburetor. Frantically you look around for mud, water, anything, to smother the fire. Nothing. Helplessly, you stand by and watch your car burn.

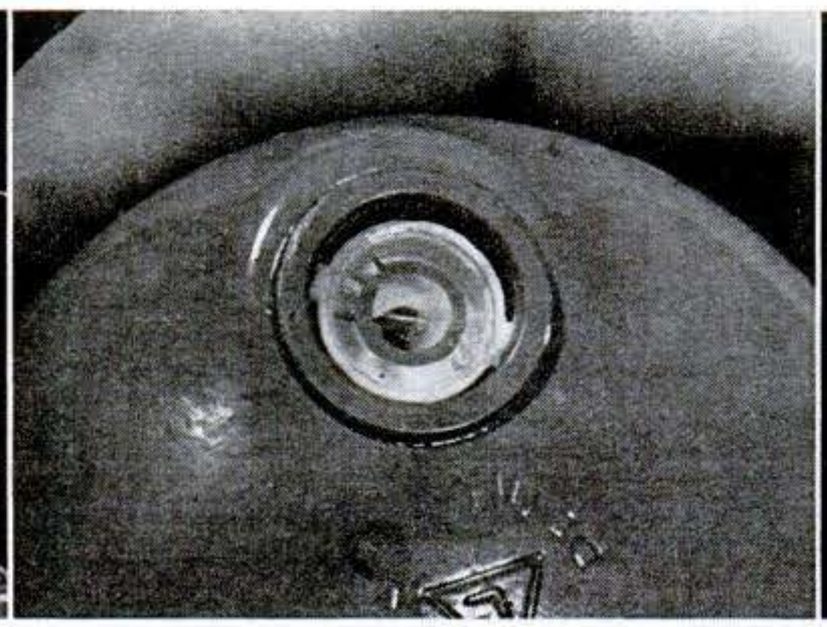
Maybe this has never happened to you. But if you own a car, camper, or boat, and don't carry a fire extinguisher in each, you could be in trouble. In 1970, 461,000 motor-vehicle fires (car and camper) cost motorists $73,000,000, estimates the National Fire Protection Assn. Boat fires add heavily to that cost. And these figures don't reflect the tragedies of many such fires: loss of life and injury.

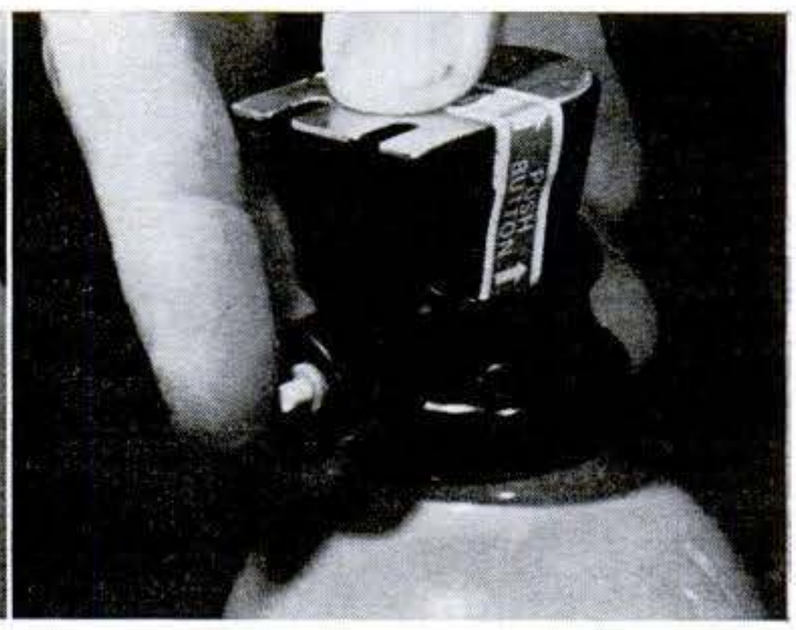
Here's the lowdown on what you should know about fire extinguishers for your vehicle or boat.

What's the right extinguisher? A dry-chemical (powder) unit with an Underwriters' Laboratories label of approval for BC-class fires. The B means it's effective against burning gasoline and similar combustibles. The C indicates it's effective against electrical fires. Gasoline and electrical fires are the two most common types of fires in vehicles and boats.

Extinguisher sizes most suitable for car, camper, and boat are 10-, five-, 2½-, and one-pounder. Approximate cost for these portable dry-chemical units is $50, $30, $15, and $7, respectively. For where-to-buy information, see facing page.

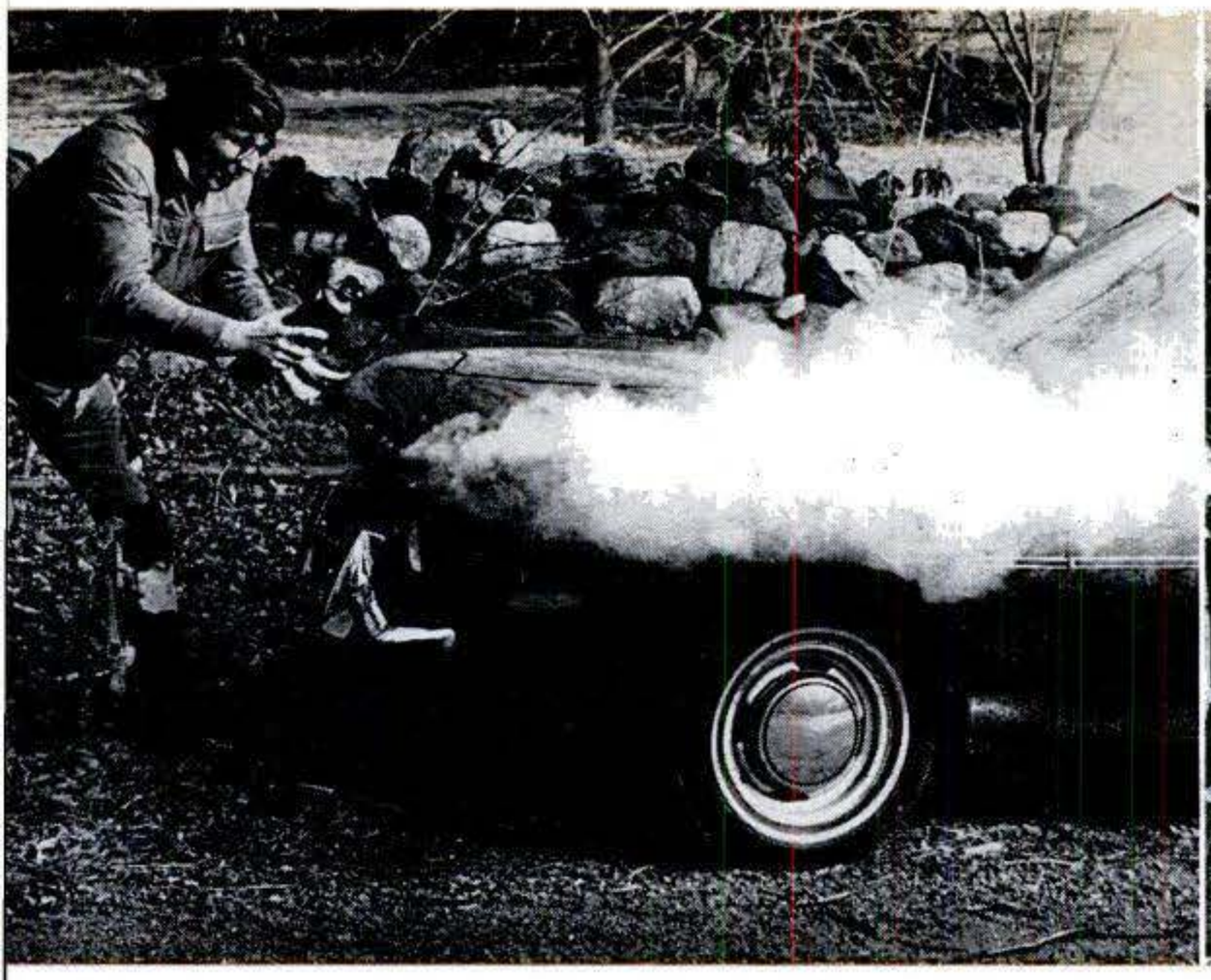
The UL label? That goes on the extinguisher only after UL men like these put it through rigid tests.





Each UL-approved extinguisher has a pressure gauge that tells you whether the unit's fully charged. Check the gauge every six months. The gauge at right is a pushbutton type. When the button is pressed, it pops back out if the extinguisher's okay.

Copyrighted material



Raise the hood a few inches first. Letting in air helps dissipate the smoke and keeps the flame from flashing out at you.

Aim at the base of the flame and shoot. After extinguishing the blaze, watch the fire area. Heat could cause it to re-ignite.

What size should you buy? Either a 2½-, five-, or 10-pounder. That's the weight of the chemical content, not the extinguisher itself. You can buy extinguishers with less than 2½ pounds capacity, but these aren't recommended except as a supplement to a larger extinguisher (at least a 2½-pounder).

Shy away from beer-can-size extinguishers that aren't UL approved, advises the NFPA. Besides their small capacity, their reliability is uncertain and their range is usually dangerously limited.

Using the extinguisher. Hold the nozzle as close to the flame as you can without burning yourself. Point it directly at the base of the flame and shoot short, sweeping bursts of chemical across the flame's base. Always turn off the ignition in a car, boat, or camper before starting to fight the fire.

If the fire is in the upholstery and hasn't burned into the padding, spurts of powder aimed at the flame's base may extinguish the fire. But if the fire has burned deep into the padding, water must be poured into the padding to extinguish it thoroughly. If the fire is caused by an electrical short in the dash or elsewhere, jerk loose the wire that's shorted, then shoot powder at the fire.

Above all, remember that a fire extinguisher is for use on fires that have just begun, not raging holocausts. If the fire is already shooting 20 feet into the air, don't even try to fight it—run fast.

Fire prevention. The most common causes of fires in cars and campers are carburetor backfires, fuel leaks, faulty wiring, and burning cigarettes that end up in the upholstery instead of the ashtray.

Repair small leaks immediately, and keep the engine block clean. A plug wire that drops off can spark against the engine block, igniting oil and grease. Keep the battery terminals clean. When a back-up light, interior dome light, cigarette lighter, or any other electrical accessory malfunctions, repair it immediately. You may have the beginnings of a short. And don't substitute wire or foil for a fuse.

Put out cigarettes in the ashtray. Don't throw them out the window—they may blow back inside the car and ignite the upholstery. Don't smoke when your vehicle is being refueled. And don't allow the gas attendant to smoke. Always use noncombustible cleaning agents on upholstery—never gasoline or flammable liquids.

Even carrying a spare can of gas is risky business. If it's kept inside the trunk or passenger compartment during the summer, it can expand, causing vapor leakage that can be ignited accidentally.

If you own a boat, check the gas lines for leaks and abrasions, and repair any immediately. Check for leaks around the carburetor. Never leave gasoline- or oil-soaked rags lying in the boat. Each time you pressurize the fuel system, check the lines for leakage. The best way to fill the tank is with the tank on the dock, so any gas spillage will not be in the boat. If you own a cabin boat, ventilate it thoroughly before starting the engine.

Maintaining the extinguisher. Keep it wiped off and clean. Look at the pressure gauge every six months to make sure the pressure is adequate. Don't test the extinguisher by pressing the trigger for a second to see if it works. Every time the extinguisher is discharged, it should be recharged. Not because all the powder is gone, but because the unit loses pressure—powder gets on the seat that seals the nozzle and allows the compressed air to escape.

To get your extinguisher recharged, look in the phone book for a dealer who is a member of the National Assn. of Fire Equipment Distributors. Every five years you should take your extinguisher to a NAFED man and have it tested hydrostatically, to make sure the container is still good. PS

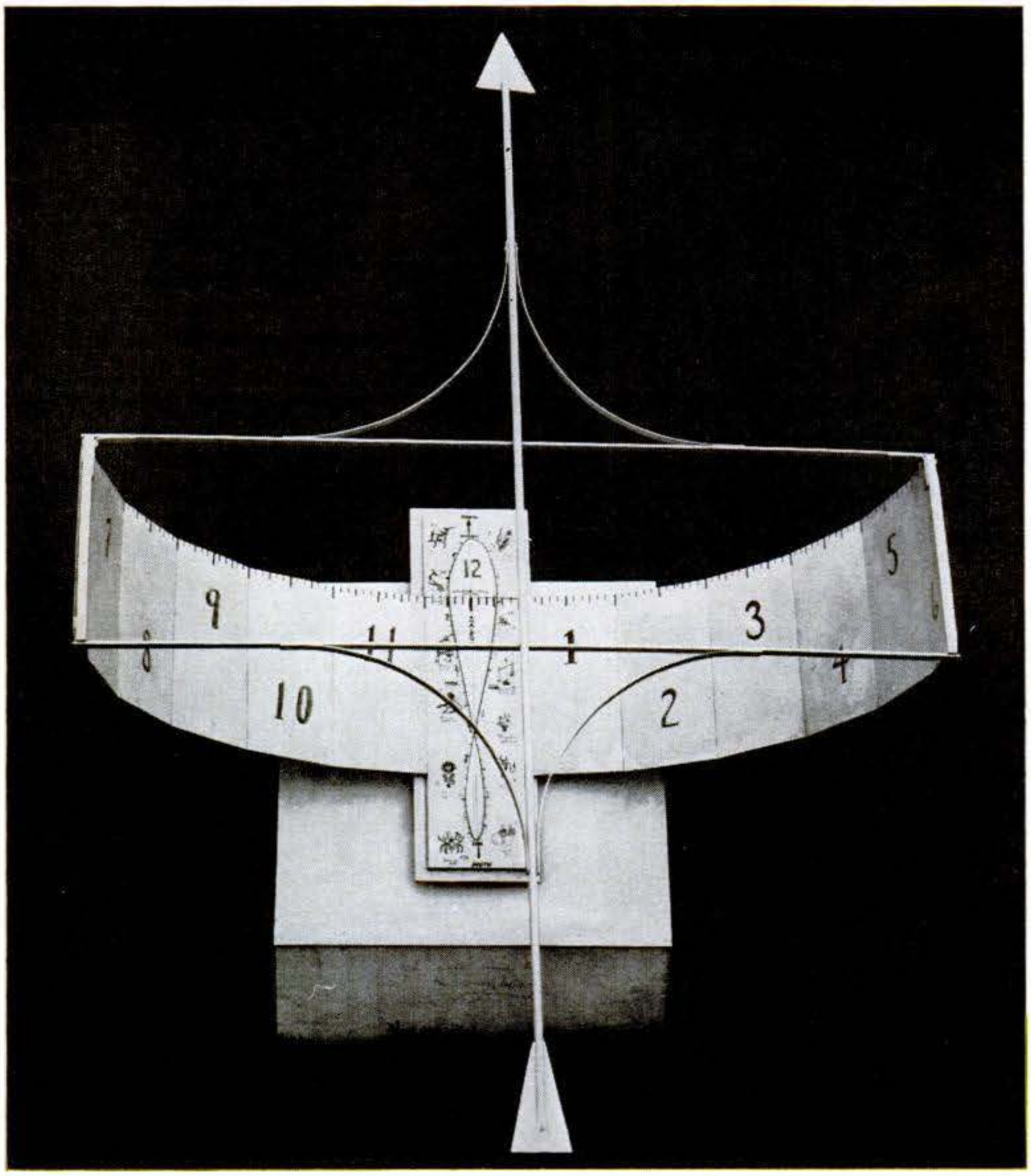
Where to put it. A quick-release mounting bracket comes with most units. In a car, put the extinguisher somewhere in the passenger compartment. If space allows, the side panel forward of the right front seat is ideal. In a camper, mount one in the cab and one in the living area. In a boat, place it near the helmsman.

WHERE-TO-BUY INFORMATION

UL-approved dry-chemical fire extinguishers are made and distributed by: American LaFrance, Ransom, W. Va. 25438; Ansul Co., Marinette, Wis. 54143; Badger-Powhattan, Ransom, W. Va. 25438; BernzOmatic Corp., 740 Driving Park Ave., Rochester, N.Y. 14613; Buckeye Fire Equipment Co., 890 Nickel Plate Dr., Cleveland, Ohio 44113; Casco Products Corp., 512 Hancock Ave., Bridgeport, Conn. 06605; Fire Atak, Ltd., Toronto 8, Ont., Canada; Fire-End and Croker Corp., 656 Gerard Ave., Bronx, N.Y. 10451; Fresno Hardware Co., Fresno, Calif. 93721; FyrFyter, U.S. Hwy. No. 1, Newark, N.J. 07114; General Fire Extinguisher Corp., Northbrook, Ill. 60062; Kidde and Co., Belleville, N.J. 07109; Pem-All Mfg. Corp., Cranford, N.J. 07016; R. C. Industries, Inc., Linden, N.J. 07036; Safety First Products Corp., Elmsford, N.Y. 10523; Stop-Fire, Inc., New Brunswick, N.J. 08902.

Copyrighted material

Amazing Sun Clock Tells Time



Attractive as it is accurate, the sun clock makes a fine addition to anybody's backyard.

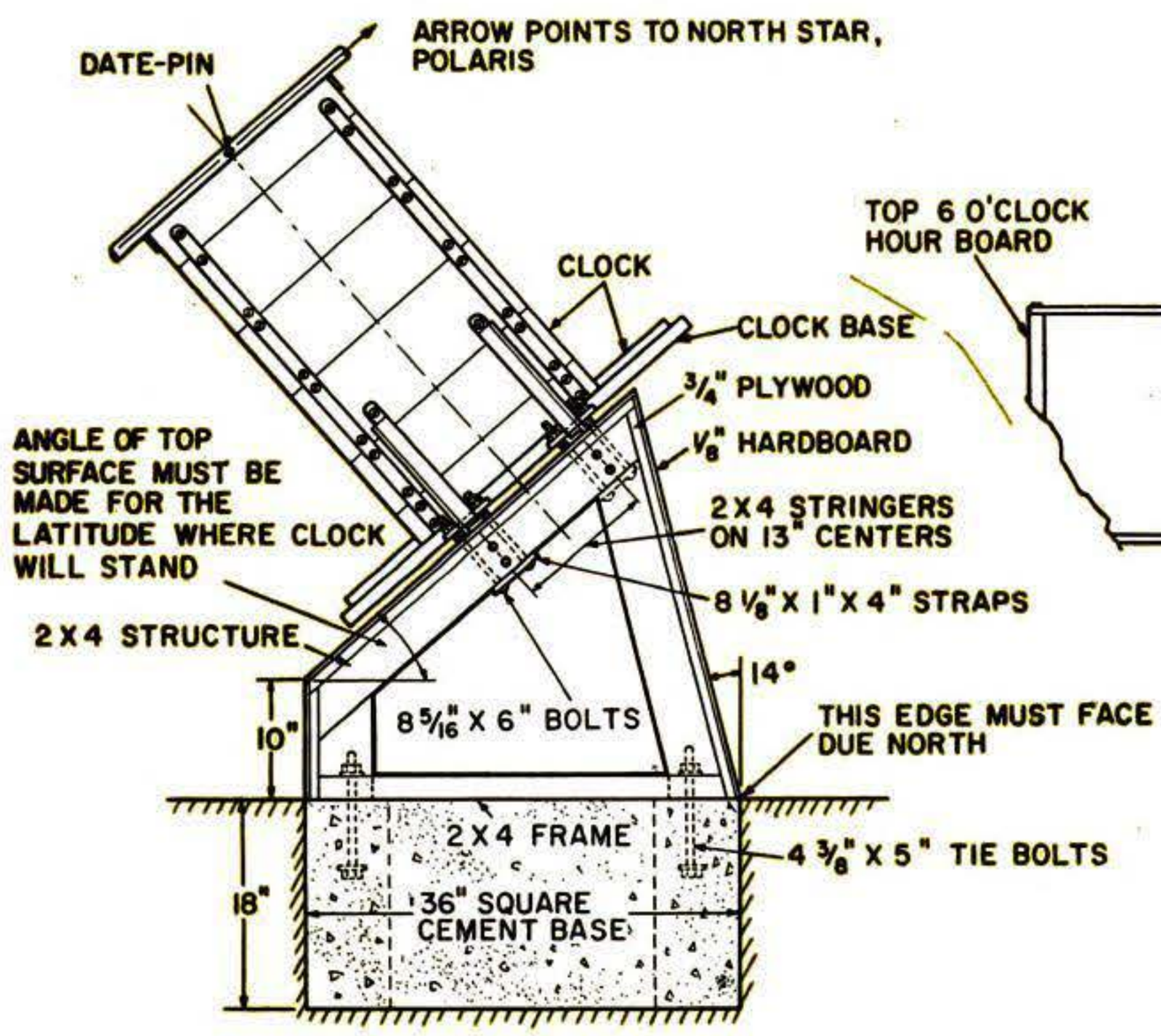
Don't want it yard-size? Build a scale model that's almost as accurate

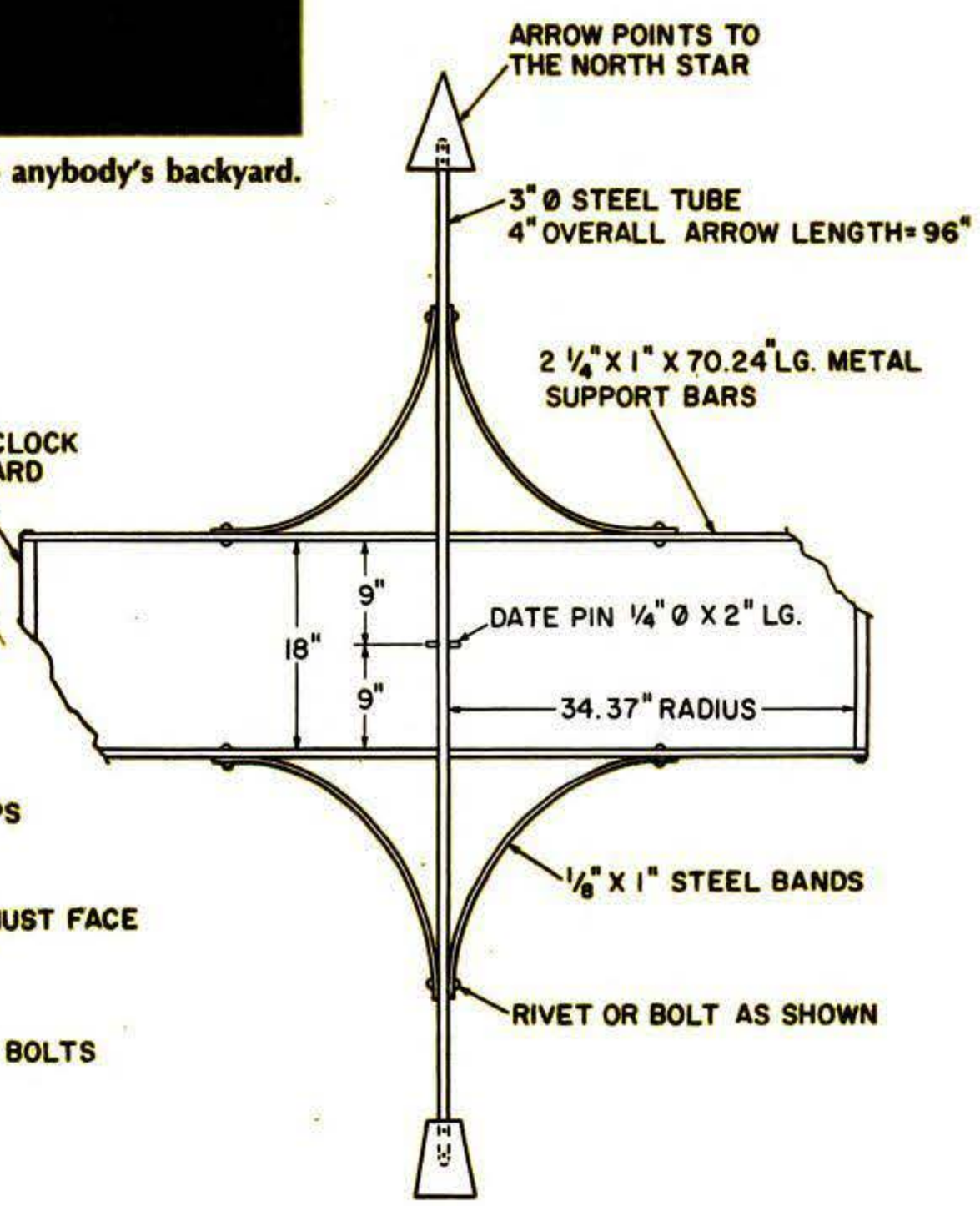
By ROBERT W. ELLMS

This sun dial is no joke. It runs forever without attention, tells time to the minute, and even gives you the date. On top of that, it's a handsome addition to your yard.

What makes the clock so accurate? That skinny figure eight on the facing page. Called an analemma, it automatically corrects your clock to compensate for the difference between sun time and clock time.

Regular sun dials get off by as much as 16 minutes 19 seconds at various times of the year. This happens because the Earth's path around the sun is not a circle, but an ellipse. So a day in sun time—that is, the time from when the sun is directly overhead until it's directly overhead again—may be a few seconds more or less than 24 hours, depending on where the Earth is in its lopsided orbit.





Copyrighted material

Right to the Minute

For convenience, we chop the years into 365 equal 24-hour segments, making all days the same length. But if you measure by the sun, those few seconds a day add up, and an ordinary sun dial can be up to 17 minutes "fast" or "slow."

The analemma is simply a graph of the sun's deviation from clock (average) time. Based on the date, it tells you how much the sun is ahead of or behind average time. Subtract or add that amount and you're on the button. It also indicates the date.

When I built the sun clock, I made it large—about 5′ tall—for maximum accuracy and for visual impact in my yard. You can scale it down if you like, but remember to scale down the analemma proportionally. If you cut the radius of the clock face in half, then you must make the analemma half-size, too.

How does the clock work? Just like all other sun dials—with a few refinements. The arrow—centered over the semicircular clock face—casts its shadow on the face to tell time. Perpendicular to the arrow, and at its exact center, is the date pin, which adds its own shadow.

To "read," these shadows, let's take an example. Say it's November 1. At noon (sun time) the arrow will cast a shadow directly through the center of the analemma, which is centered on the 12 noon mark on the clock face.

The date pin will cast a shadow intersecting the analemma at the November 1 mark, giving you the date. The analemma also indicates that at that date, sun time is about 17 minutes ahead of clock time. This means you must subtract 17 minutes from all readings the sun dial gives on November 1. A reading of 12 noon means it's actually 11:43 a.m.

Building the clock. Start with the base. The drawings show how to build it, but you'll have to pay attention to two factors when you locate the base. First, make sure one face of the block foundation faces directly north. Line it up on the North Star on a clear night. And when you add on the wooden part of the base structure, make sure its highest side is on the face of the foundation that will face north.

Second, the angle of the slanted top of the base must be equal to the latitude where your clock will stand. In my case, this angle is 41 degrees 20 minutes (for Cleveland). You can find your latitude—accurately enough for this purpose—by checking a good atlas. Follow these two rules and you'll have no trouble orienting the clock with its arrow pointing directly at the North Star.

When the base is complete, move on to the clock portion—the semicircular face, the pointer arrow and its supports, plus the brackets that fasten this entire unit to the base. Try to make the semicircular face a true uniform arc with a radius of 34.37″, measured from the pointer arrow.

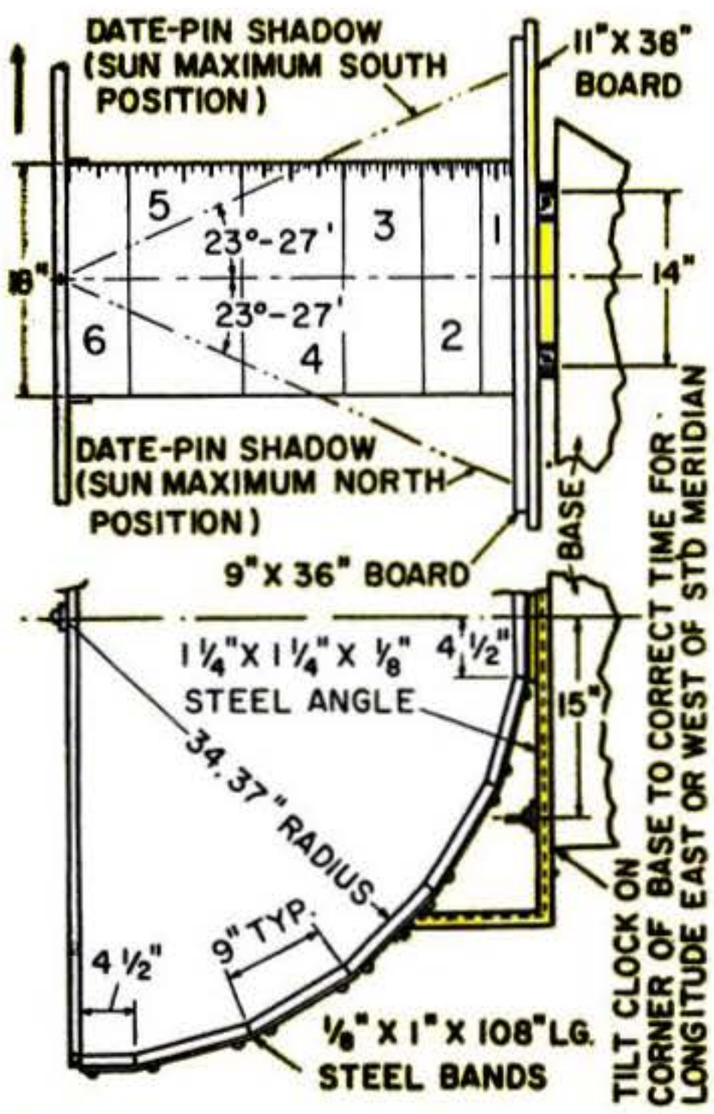
With the upper unit done, you're ready to fasten it to the base.

A final trick. With no additional adjustment, your clock will read true *local* sun time. But our clocks run on solar *mean* time: All clocks in a given time zone are set to read the solar time of the meridian in the center of the time zone. In the Eastern zone this standard meridian is the 75th. Central—90th; Mountain—105th; Pacific—120th.

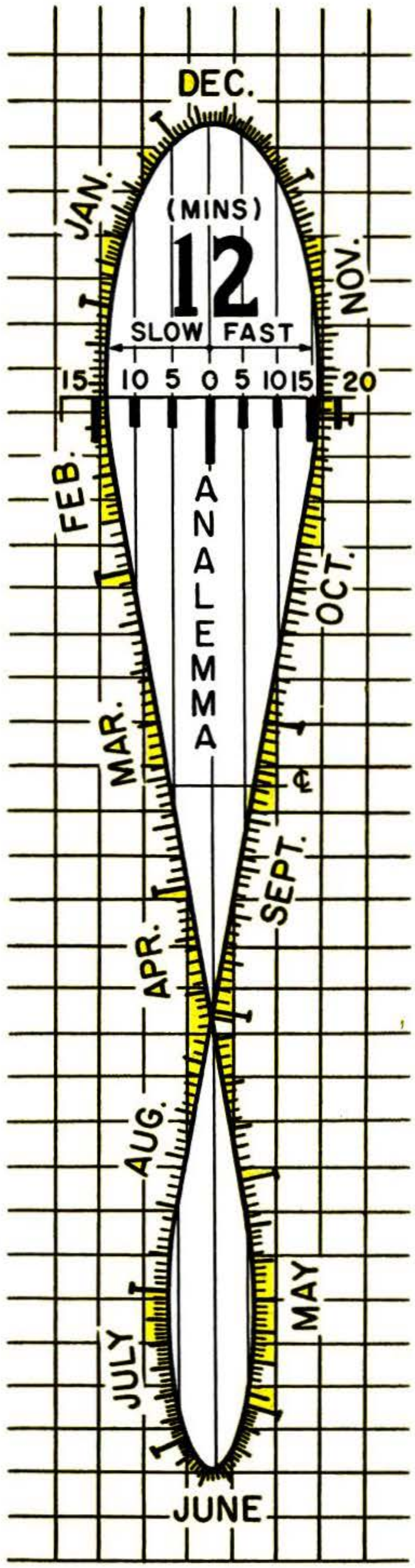
If your clock is set up on a standard meridian, it won't need adjustment. But I live at longitude 81 deg. 43 min.—six deg. 43 min. west of the Eastern standard meridian.

So when I fastened my clock to the base I had to angle it slightly, or it would have read slow. Standing to the

[*Continued on page 117*]



Clock goes together in two separate units—base and upper clock portion. Critical points to watch: Arrow must point directly at North Star, and clock face should be a true circular arc. Top sketch above shows how author computed analemma size to match clock.



Analemma is the key to accuracy

Transfer analemma onto a grid of 1" squares to enlarge it for clock made to author's dimensions. Clip from magazine and use as is if you are making a quarter-size clock.

Copyrighted material

Two Unique Roofing Systems

The one here is metal—turn page for a rubber system. Chosen for our Lockbox, each adapts to other structures

Third in a series

By AL LEES

No ordinary roof would do for the Centennial Lockbox—the design and technique had to be as innovative (and as practical for do-it-yourself application) as the pole-and-beam structure itself. And the roofing had to fit our total-security concept—which meant, for leisure homes in remote areas—nonflammable, maintenance-free materials.

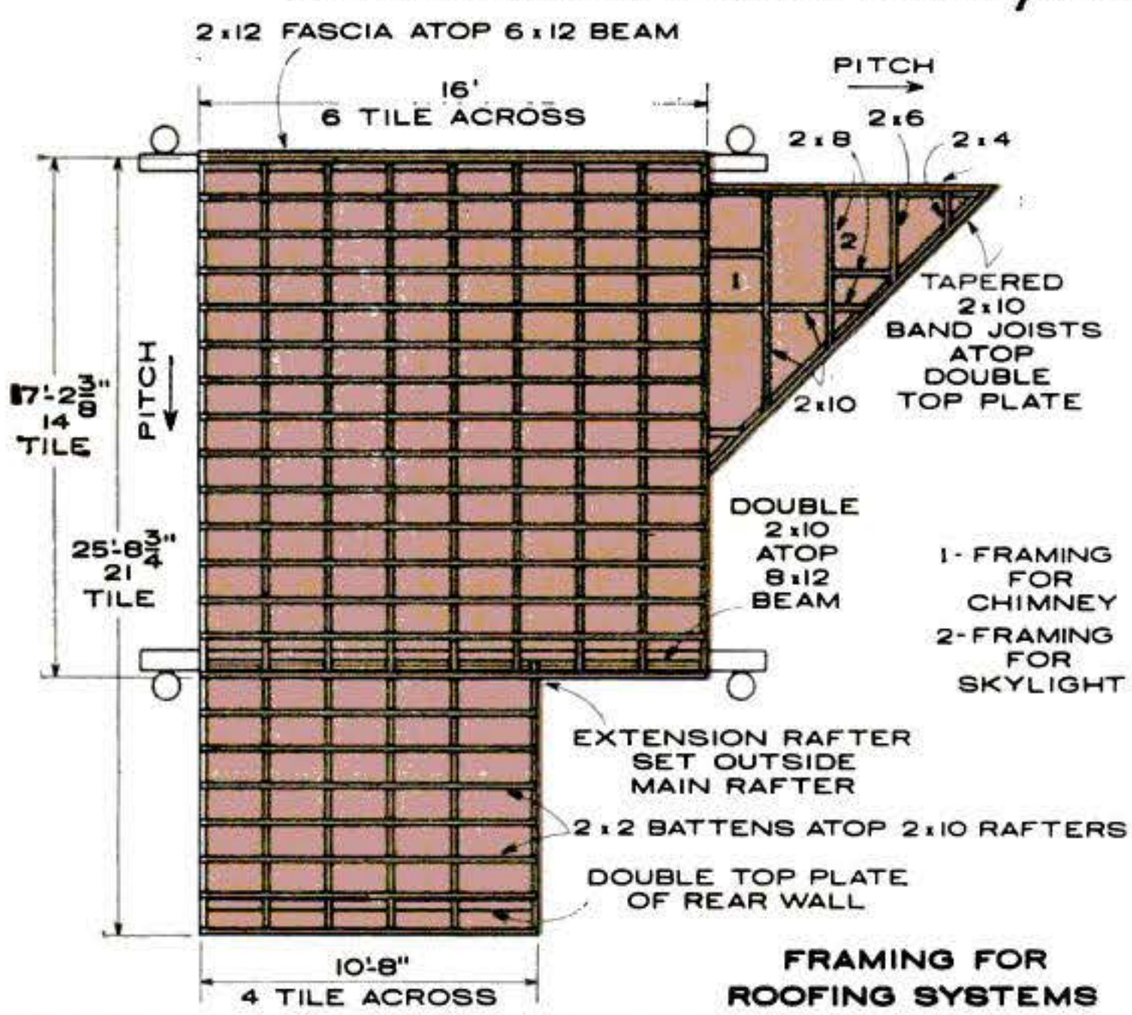
Since one of the major advantages of pole-and-beam design is that it gets you under shelter fast (you can erect your roof before your walls) we needed *quick* systems that eliminated the usual fussy details.

We also decided that a do-it-yourself roof for the main house had to be applied without scaffolding, and preferably without our having to scramble up and down the pitch.

So we discarded our architect's specs and went in search. For the main roof, we chose a metal tile system—handsome as it is novel—that gives the heavy butt line of spanish tile without the weight (only 180 lbs. per square). The units are formed from galvanized steel, coated with bituminous compound, covered with ceramic chips in your choice of seven colors (we chose the rich Sable Brown) and treated with weather- and fungus-resistant sealer. The system is called Decramastic, and it's available from Automated Building Components Inc., 7525 N.W. 37th Ave., Miami, Fla. 33159. Everything you need for the Lockbox main roof will run you under $290.

The separate roof over our triangular entry called for a different treatment. This is virtually a deck, with about a 1:12 pitch to prevent puddling. Plywood sheathing was fine, here—but what surfacing would be practical for a small, flat roof that supports both a skylight and the flashing cone for our fireplace chimney? A neoprene system—Gacotred—comes from Gates Engineering, 100 So. West St., Wilmington, Dela. 19899; enough materials to complete our triangle add up to less than $38. The neoprene comes in five colors, and, by chance, the brown is an exact match for our Decramastic tile!

Remarkable metal-tile system requires no sheathing, so you can work

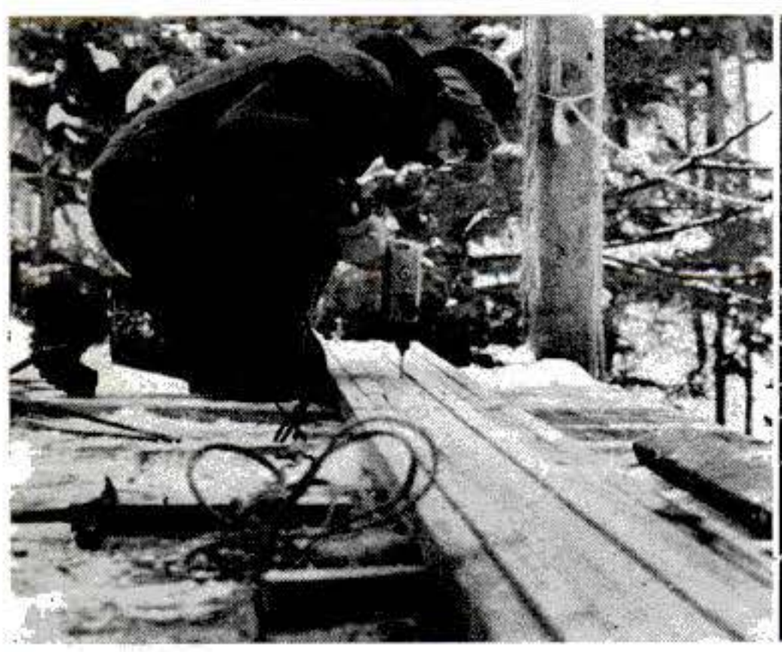


FRAMING FOR ROOFING SYSTEMS

Here's what you get when you order your Decramastic materials for the Lockbox: 120 tile (3.9 sqs.); 20 lin. ft. of ridge cap, specially pre-bent for this application; 20 lin. ft. of 2"-by-3" eave drip and 42 gable end caps (21 each, right and left). All these units are the coated sheet metal described above. You'll also receive an installation kit containing hex-head screws and ring-shank nails, 2 qts. emulsion, 10 lbs. granules, plus a spray can of PVA sealer. The last three items are for patching any tile damaged in transit or installation—though you'll note that more tiles are provided than the sketch at left calls for. This gives you the option of adjusting courses (see box, right).

Each tile is 2'10¼" wide and has four valleys; with side laps, it takes six tile to cross our 16' cube. Since four tile make up a 10'8" width, we adjusted the roof framing over the rear extension so as to avoid any cutting. Though the system is engineered around whole tile, you can trim Decramastic units with tin snips. (For clarity in our sketch at left, the extension rafter at the right side of the kitchen/bath wing is shown detached from the rafter above it. For strength, it's best to cheat the latter over enough to spike these lapped ends together. You may, if you wish, equalize spacing between the balance of the rafters, instead of maintaining a rigid 2'-on-center positioning.)

Spacing of the 2-by-2 battens is critical, since the tile flanges are formed to bridge 14⅝". You anchor each butt flange with a screw or nail driven just off-center of each valley. Each fastener (we used two screws and two nails per butt) pierces the butt flange *and* the top flange of the tile in the course below, securing tiles into one big leakproof metal membrane. For driving the screws, you'll need a standard screwdriver accessory for your

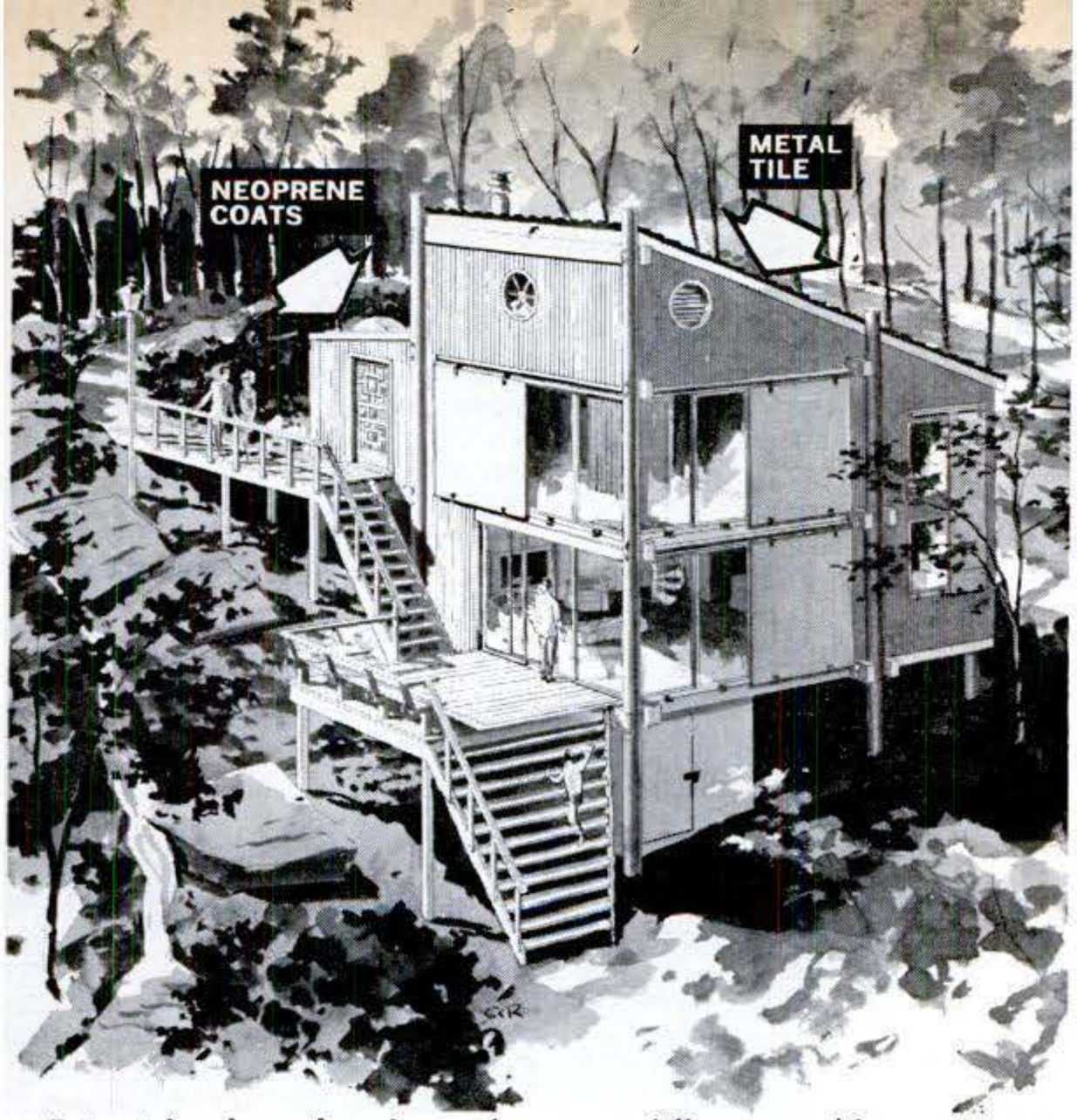


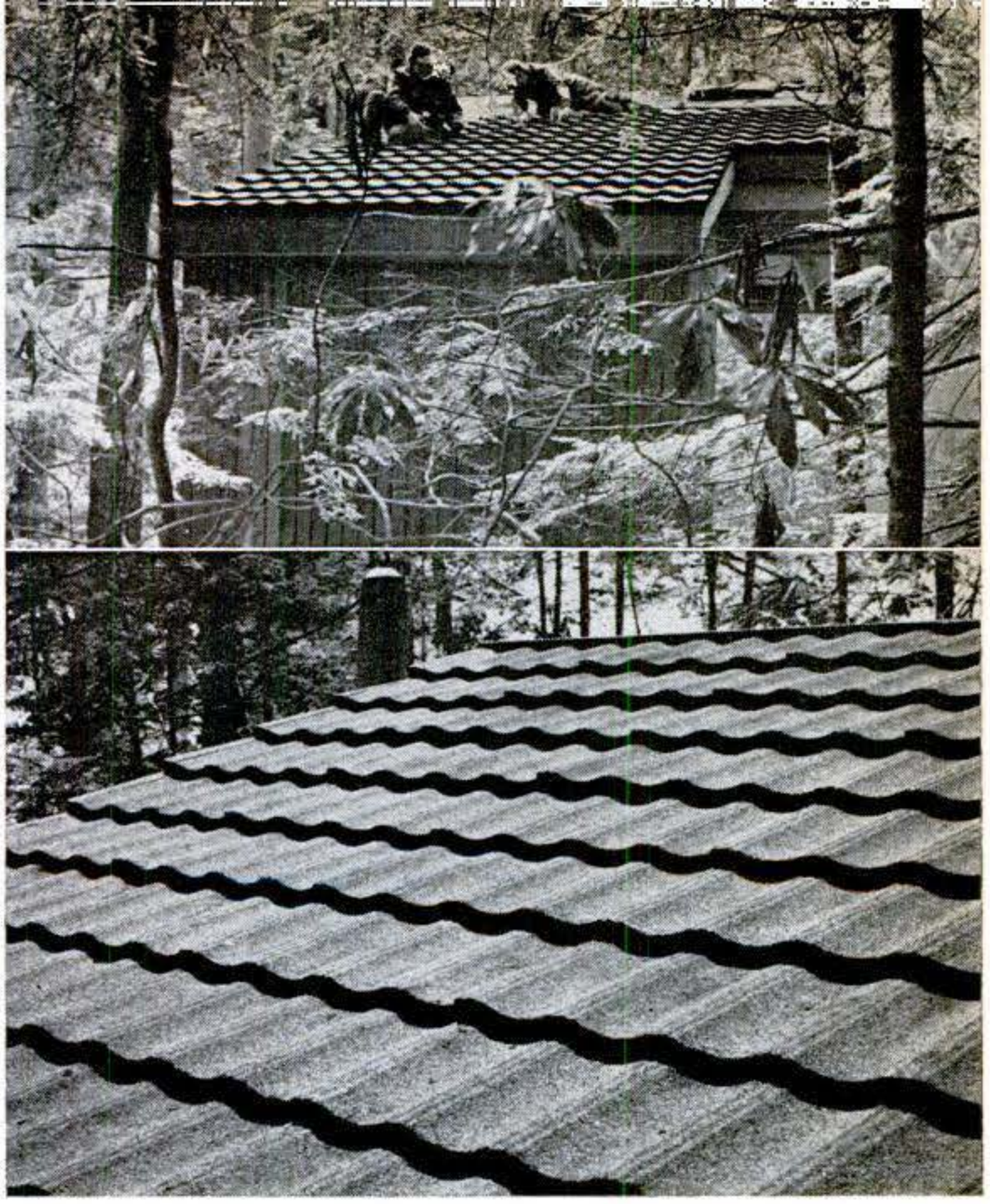
Predrill 2-by-2 battens for single 16d hot-dipped-galvanized common nail at each rafter crossing. Co-builder Ron Nelson has marked one batten in place on rafters, now uses it as template for drilling others.

Spacing is critical as battens must be an accurate 14⅝" o.c. for metal tile to fit. Here, Lees uses two 2-by-2 blocks (one shows at nailing position, other is off right) cut to length that provides that spacing.

Work from eaves up on lower part of roof. Student helpers, above, are starting new course: Bill is driving self-tapping screw through gable end cap (similar to unit Larry holds) that fits over end of tile.

Copyrighted material





Entry triangle and main roof present different problems. Latter has substantial pitch but is relatively inaccessible. Entry is minimal-pitch deck, pierced by skylight and fireplace chimney.

up through the rafters

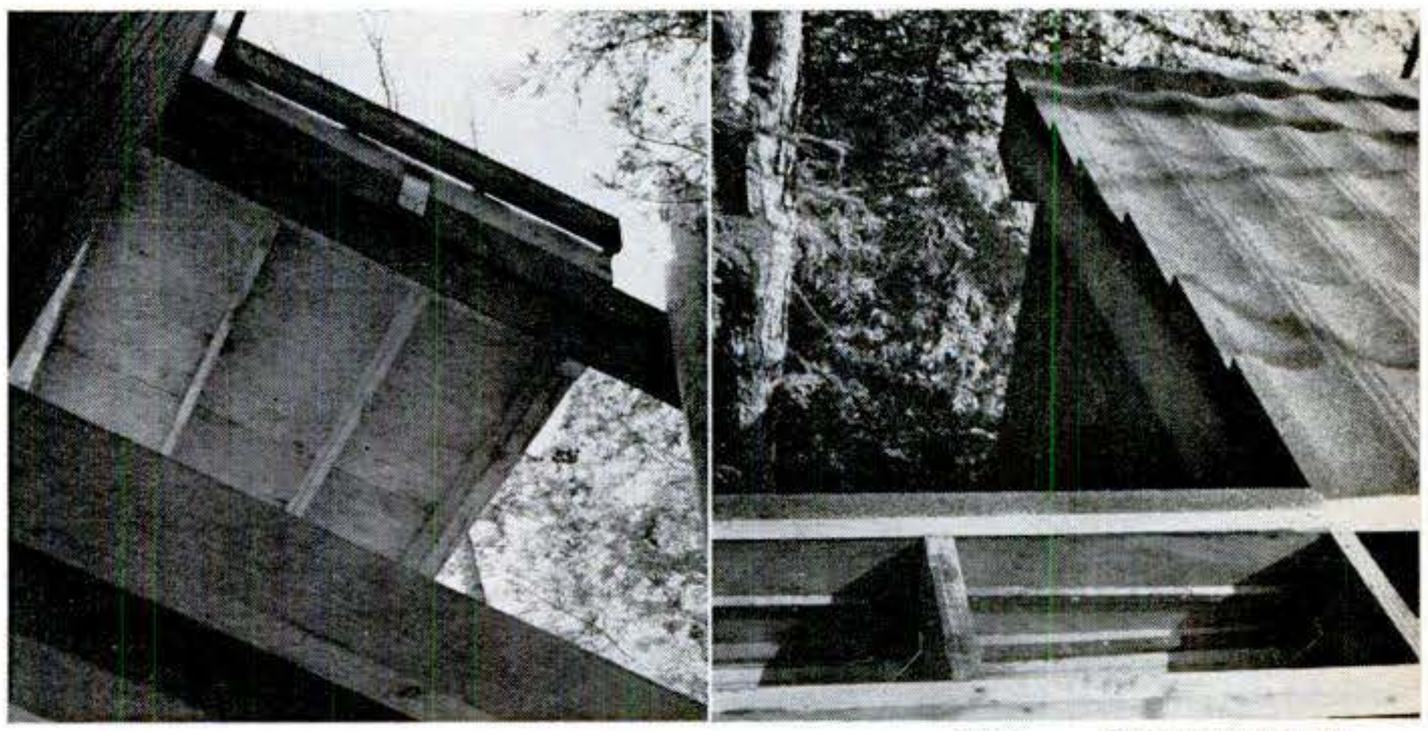
electric drill—one capable of about 1,700 rpm—plus a hex-head socket driver. No predrilling is required for either screws or nails, though you may prefer to drill through the four layers where the flanges of two tile and two end caps must overlap.

The ridge cap and eave drip come as a pair of 10′ strips, each with provision for the lap joint that's necessary at both the top and the bottom of the roof. The end of one strip in each pair is taped for easy stripping of the emulsion/granule coat to bare metal. Apply roofing cement to this lap before seating the extension strip atop it.

As with other roofing applications, don't tackle the job at high noon on a bright day; roofing's a hot job, and heat tends to soften this emulsion so the toes and heels of your shoes can gouge the granule coating. It's possible to walk on a Decramastic roof (and our slightly under 4:12 pitch is a comfortable one). You place your feet in the valleys just above the butt line; never step on the crowns or on unsupported between-batten areas.

To patch, spread emulsion on bare spots, press granules into surface, spray with sealer.

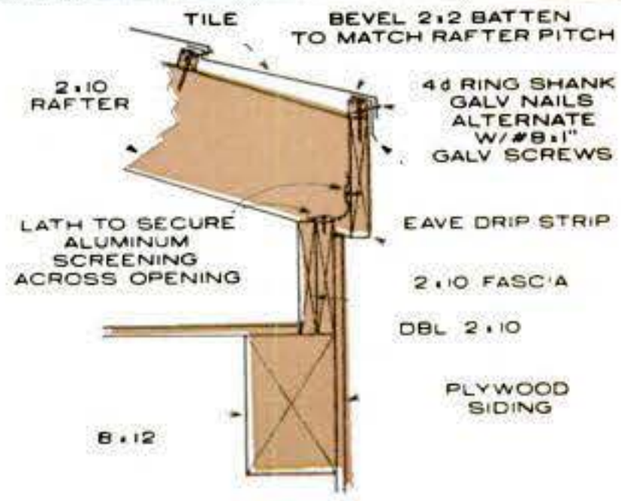
Work from ridge down on upper part of roof. Fastest anchoring is by means of 1″ hex-head self-tapping screws and driver accessory in portable drill. Alternate fastener is black galvanized ring-shank nail.



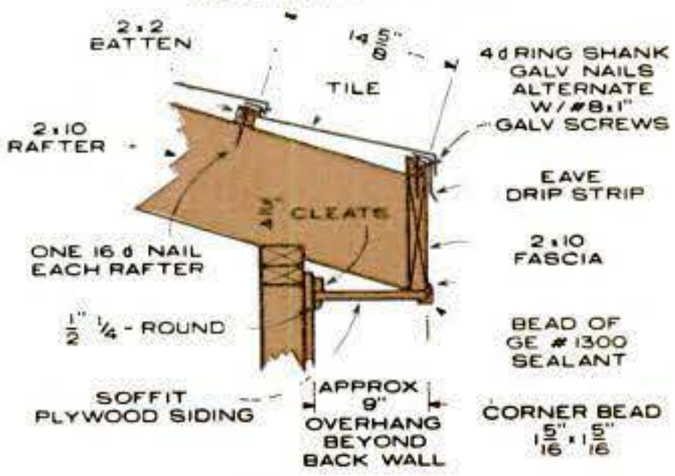
Eave-overhang treatments can vary

Precisely dimensioned plans for a pole-and-beam structure just aren't practical. Assuming that poles are set at varying levels on a steep site, each pole will taper a different amount between equivalent vertical points. The taper also makes it difficult to set posts exactly plumb (clapping a level against a tapered pole doesn't tell you much). It's best if the poles lean slightly inward—that is, toward the cube they're supporting. This could mean that the horizontal front-to-back dimension at the attic-floor level may be less than at the first-floor level. In our prototype, the first-floor measure is 16′10″; but the attic floor, front-to-back, is just under 6′4″.

To superimpose the precise Decramastic grid on so flexible a cube, you may have to adjust your eaves projection or alter the course count (only six deep over kitchen/bath wing, instead of our seven). Photos and top sketch show how we utilized slight overhang of short rafters as above-insulation vent. Bottom eave is boxed.



SHORT RAFTER OVERHANG DETAIL

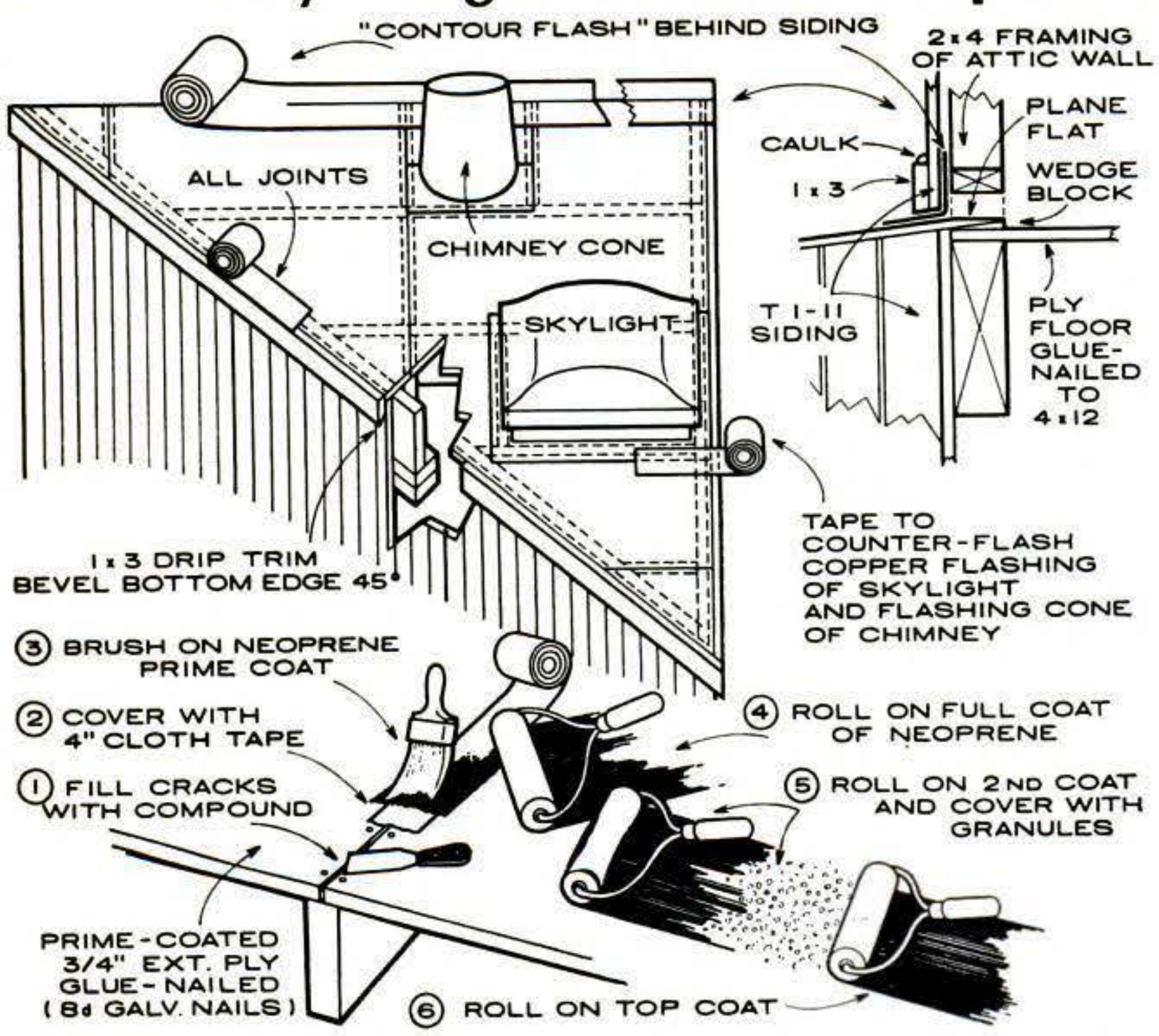


LONG RAFTER OVERHANG DETAIL

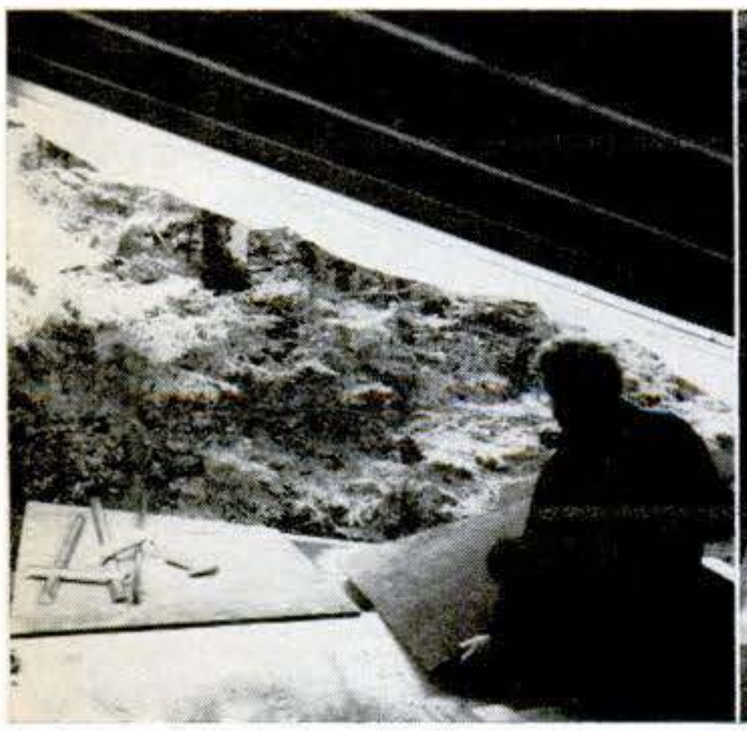
For rubber system (neoprene coats), turn page

Copyrighted material

For the entry triangle: a seamless neoprene deck



Deck for Gacotred application must be ¾" exterior DFPA A/C plywood. Interior grades with exterior glue aren't suitable. All plywood edges must be supported on primary framing or blocking (dotted lines) with sheets in moderate contact. Since damp plywood impedes adhesion of rubber coating, it's best to prime top surface and edges before nailing fitted panels in place as shown.



Prime-coat plywood panels and beveled drip trim (strips at left) before assembly. You can get entry's floor and roof both from three 4-by-8 sheets, but triangular piece is needed at both 45-degree corners. View here is from attic floor, under rafters.

Fill all cracks at joints between panels and nailed-on drip trim with compound that comes in kit; apply with putty knife and strike off flush with surface. Let dry before covering with tape.

Sprinkle granules generously over last base coat while still wet. Granules are light beige to help you get thorough coverage of dark base coat. Shaker is can with holes punched in bottom (it's seen in center of photo, right). Excess is swept off when coat dries.

After applying Contourflash with contact cement along joint between deck and sole for attic wall, base coat is rolled over it and granules are seeded on. At right is the chimney cone.

When you order Gacotred materials for this job (and if you're west of the Mississippi, write Gaco Western, Inc., P.O. Box 88698, Tukwila Sta., Seattle, Wash. 98188 for a price list) you'll get: 2 gallons each of Gacoflex N114 brown neoprene and granules; 1 gal. N-450-1 thinner; 1 qt. each of N-7 neoprene adhesive and N-74 flashing compound, plus a roll each of Contourflash elastomeric sheet (12" wide) and No. 66 cotton reinforcing tape (4").

A well-supported deck is important; framing details for the joists shown in dotted lines at left were given in the previous installment. Use only hot-dip galvanized nails (6d or 8d common) to anchor the ¾" plywood, spacing them every 6" at panel edges, 12" elsewhere. For extra rigidity, we treated this deck like our APA glued floors, running beads of construction sealant along the beveled or tapered edges of all support members before laying the plywood in place.

For the prime coat, mix 2 parts of the N114 neoprene with 1 part thinner and apply with a ¾"-nap roller. Once the prime coat cures (overnight is best), you can expose the panels to rain without risking a long dry-off delay (none of the Gacotred steps should be undertaken in wet weather; a shaded clear day is best). Before thinning, the N-114 neoprene is the color and consistency of Hershey syrup. The N-74 compound, on the other hand, is a troweling paste, resembling standard roofing cement in everything but smell. After filling all joint cracks, let the compound set thoroughly before applying the tape.

The tape (which will be Gacoflex 66 or Permacel P-66) is like a giant roll of adhesive tape. Press it firmly to attain full contact (we rolled the edges with a wooden wallpaper seam roller); at all intersections, where two strips of tape meet, spot-prime the first strip and let the primer dry tack-free before lapping the second strip an inch or two. When taping is complete, brush-coat all strips. Should any tape be exposed to wetting by rain, frost or dew before this seal-coating has set, replace any damp or wrinkled sections.

Since you'll be working from the attic floor, as shown in our top photos, you'll be able to install only the sole plate of this side wall, as shown in our section. Once this was in place, we cut an 18"-dia. hole and bracketed a trial section of fireplace chimney through it so we could install the flashing halves and cone that come with the Heatilator. Space between cone base and sole plate was tight, so we bent up the top edge of the upper flashing half to set against the sole (this option is omitted from our section). Next we ran masking tape across the roof 6" from the sole and parallel to it. Then we brushed on two coats of N-7 adhesive (a contact cement for neoprene) coating the 6" strip of roof and the sole edge. After wiping the back of the Contourflash strip with thinner, we applied a coat of N-7 to it and, when all coats were tack-free, made the bond, using a slip sheet (as when applying plastic countertop).

You're now ready to coat, sprinkle, and top-coat the roof as shown at left, rounding out your weekend's work. Next week you'll erect your sidewall studs and (using the Gacotred roof as a work-deck) apply your siding, sandwiching your flashing between framing and siding. Then you'll set a 1-by-3 trim strip (coated with N-114, as were your drip trims) in a bed of N-74 compound and tack it to the siding. A caulking bead of construction sealant (we used GE's 1300, black) complete the job. You'll now have walled yourself off from the attic, so (hopefully) you'll have removed the double-layer dome from the skylight (top-right photo) to provide an escape route. PS

How to Order Your Plans

Fully dimensioned architect's plans that let you duplicate our Lockbox Leisure House on your own site have now been completed. Send $15 (check or money order) for one set of plans—$20 for two sets. Each additional set at time of original order is $5, should you need extras for subcontractors or loan and permit filing. As a bonus, you'll receive a 12-page booklet reprinting the first three installments in this series, with an expanded how-to text to get you started (one copy per order). Write Popular Science Plans Div., 355 Lexington Ave., New York, N.Y. 10017. Ask for Plan 5547: Lockbox. Three weeks delivery.

Copyrighted material

If your menthol doesn't make it,
make your menthol KOOL.

Come all the way up to KOOL.
The only one with the taste of extra coolness.

© 1972, BROWN & WILLIAMSON TOBACCO CORP.

KOOL
Filter Kings
MILD MENTHOL CIGARETTES
KOOL
FILTER KINGS
KOOL King Size

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health

18 mg. "tar," 1.4 mg. nicotine av. per cigarette, FTC Report Aug. 71.

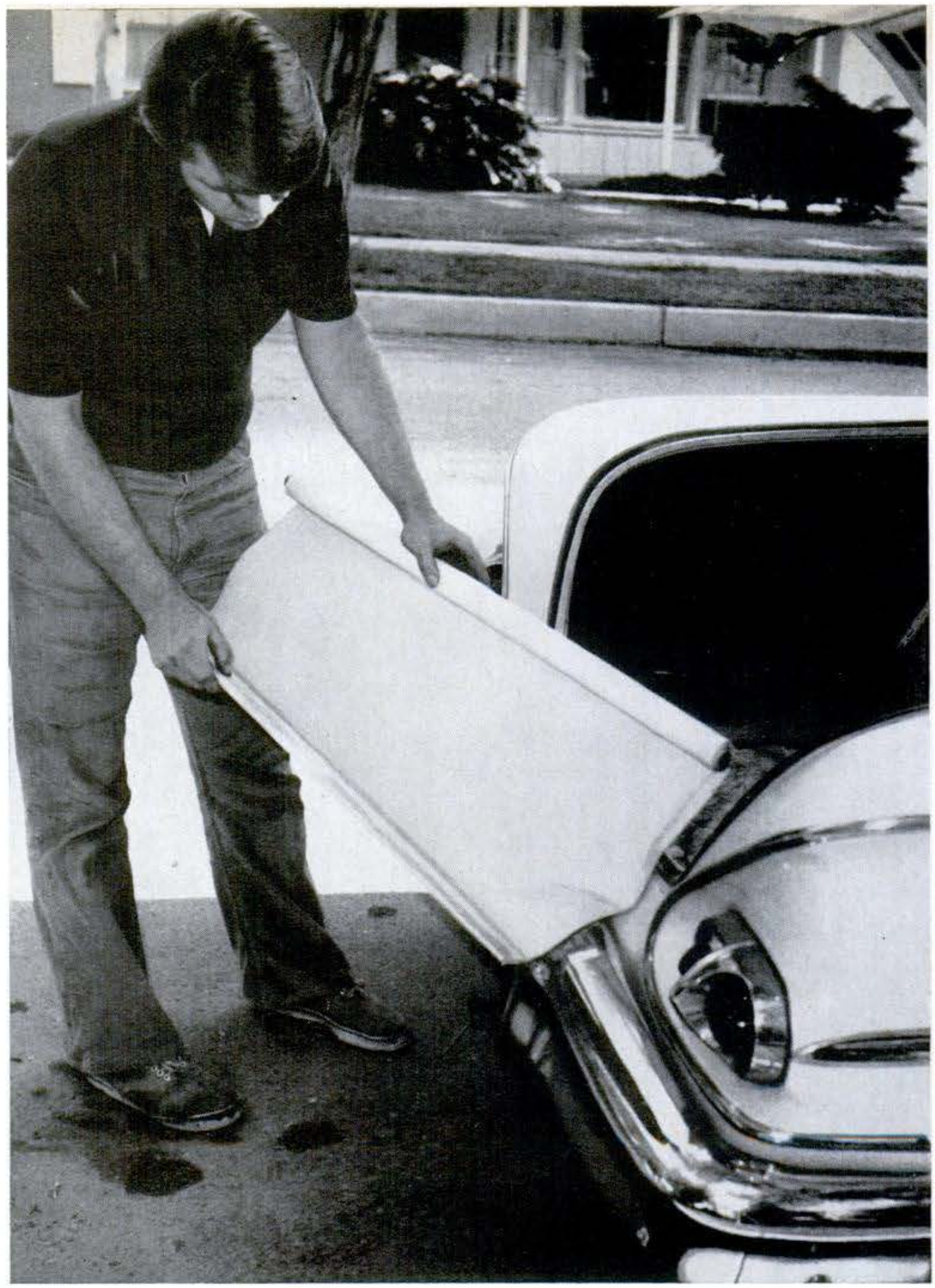
Copyrighted material

Taking Care of Your Car

Good hints others have used

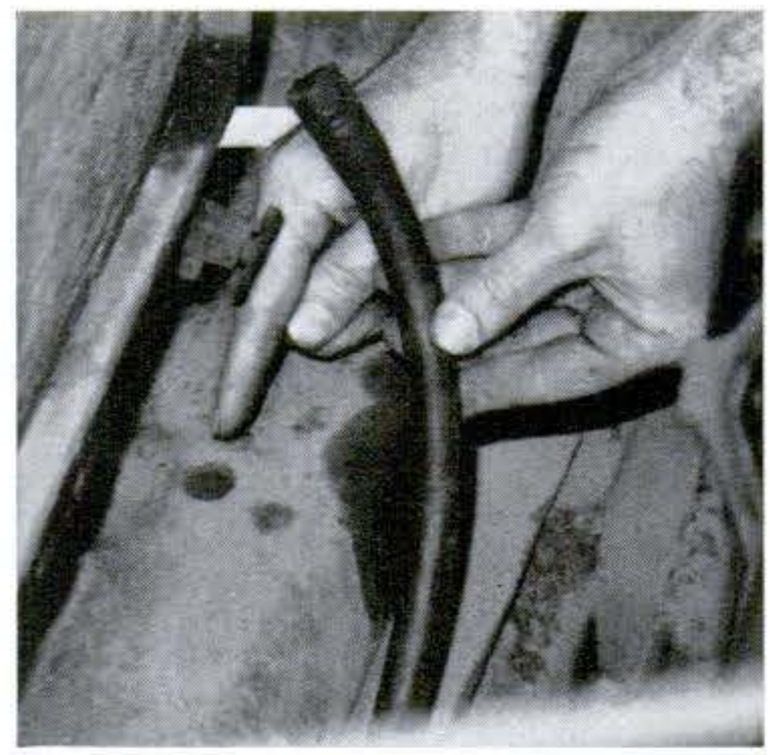
Got a car tip? We pay $25 for each one accepted. Send it to Car Care, Popular Science, 355 Lexington Ave., New York, N.Y. 10017. None are returnable.

Changing a tire at night? Clamping-pliers plus a flashlight can quickly become a trouble light to illuminate the wheel area. Clamp the flashlight in the jaws and set it where you want it. That leaves you with both hands free to change the tire.



When you're working under your car, a window shade makes an excellent mat to lie on. It prevents the ground from soiling your clothes. Rolled up, it occupies very little space in the trunk. Carry it with you for emergency under-the-car repairs.

A broken stud in the engine block can be removed by welding the end of the stud to the inside diameter of a flat washer. Next, weld a nut to the washer. Let the weld cool, then heat the metal around the stud. Slip a wrench over the nut and twist.

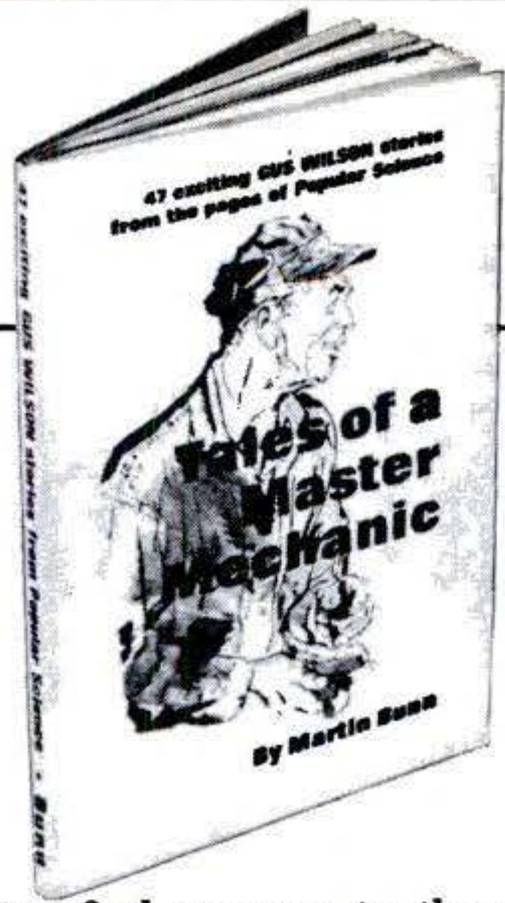


Draining your radiator doesn't have to be a messy job. Slip the end of a neoprene hose over the petcock opening and feed it through the hole in the splash pan. Now you can direct the coolant into a pan and keep it from splashing on the garage floor.

Removing a drive shaft? Upon removal, the universal joint has a distressing tendency to fall apart, letting the needle bearings scatter. Prevent this by securing the bearing cups with masking tape or a hose clamp before removing the drive shaft.

Copyrighted material

Match Wits with the Wizard of the Model Garage!



1. What old army trick should you suspect if a four-cylinder engine conks out as you step on the gas?
2. Besides dieseling, what could make an engine continue to run after you turn off the ignition switch?
3. What annoying driving symptom could result from putting all your weight on a lug wrench?

You can find answers to the above automotive problems—and many more — in a new book just published by POPULAR SCIENCE. Entitled *Tales of a Master Mechanic,* it presents 47 Gus Wilson stories reprinted from the pages of POPULAR SCIENCE.

Order your copy by sending a $1.95 check or money order to POPULAR SCIENCE Plans Div., 355 Lexington Ave., New York, N. Y. 10017, giving your name and address and asking for *Tales of a Master Mechanic.*

If you can't wait for the answers to the questions above, you'll find them in the inverted type at the right.

1. In the army, when you wanted to keep someone from making off with your Jeep, you switched the cables of cylinders one and four, either at the plugs or distributor. "The engine will start and idle," Gus explained. "But those two cylinders are firing on the intake stroke, and deliver no power. A four-cylinder engine will quit if you try to load it."

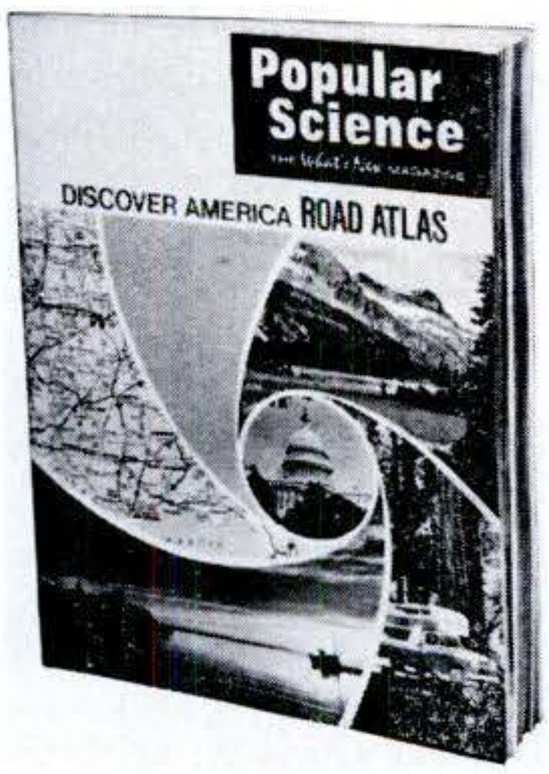
2. Gus found that another mechanic, in checking a nonfunctioning oil-warning light, had pulled out "the generator warning light by mistake, then short-circuited its leads when he pushed it back in. That short let current flow from the alternator through the fuel-gauge circuit, around Robin Hood's barn, to the ignition coil. The alternator puts out juice even at idle, so it kept the ignition working after you switched off the normal circuit, and you couldn't stop the engine."

3. The symptom was a repetitive squeak from one wheel when the brakes were applied. The squeak came from a deformed brake drum. This resulted from overtightening the lugs — in the wrong sequence.

A NEW KIND OF GUIDE TO VACATION TRAVEL

Here's a unique way to spend your vacation. See one of the greatest "shows" on earth — in over 200 places where they manufacture cars, planes, TVs, boats and the other fascinating things that make our lives comfortable and enjoyable — as selected by the editors of POPULAR SCIENCE. The tours are pinpointed on a giant-sized map of the United States, which is yours as a special bonus when you buy the 1972 Popular Science Discover America Atlas. Here's what you get in this all new travel guide:

- **Extra-large individual maps of all 50 states, Canada, and Mexico. Each state map comes with its own index to cities and towns.**
- **Detailed maps of 25 U.S. cities.**
- **Maps of 12 national parks, with accommodations, seasons, fees.**
- **Seventy full-color photos of major U.S. tourist attractions.**
- **Transcontinental mileage chart.**
- **Information on main toll roads.**
- **Traffic laws for each state.**
- **Canadian tourist regulations.**
- **Mexican tourist regulations.**



This 72-page atlas is printed in full color. Maps are easy to read — photos give you lifelike previews of the spots you plan to visit. To get the atlas promptly, plus the bonus Travel Map, send in the coupon below with $1.50. Your money back if you're not delighted.

PS Dept. MAP PS772
Box 1100
Teaneck, N. J. 07666

I enclose $1.50 (check or money order; NO CASH) for the 72-page POPULAR SCIENCE Discover America Atlas and my bonus giant-size copy of the POPULAR SCIENCE 1972 Travel Map of the U.S.

Name_____

Address_____

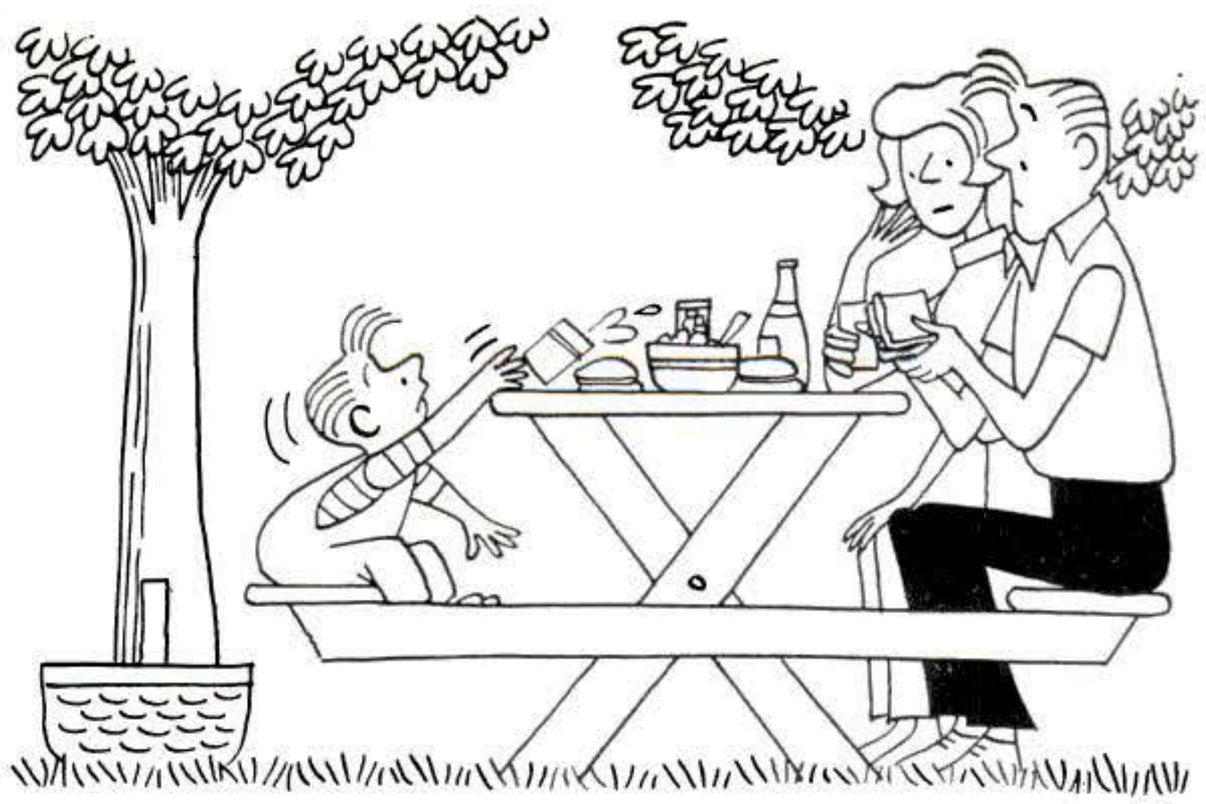
City_____

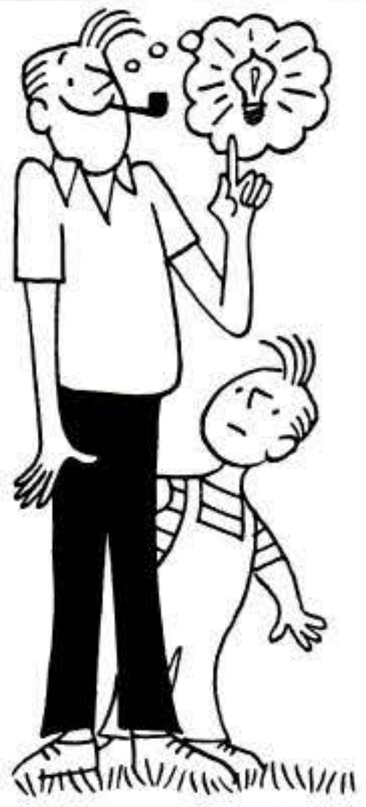
State_____ Zip_____

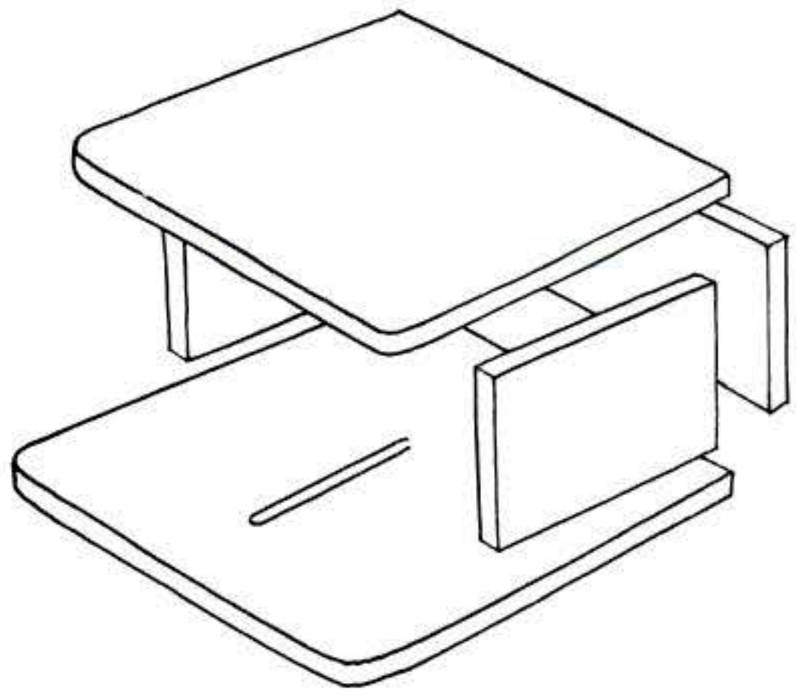
Copyrighted material

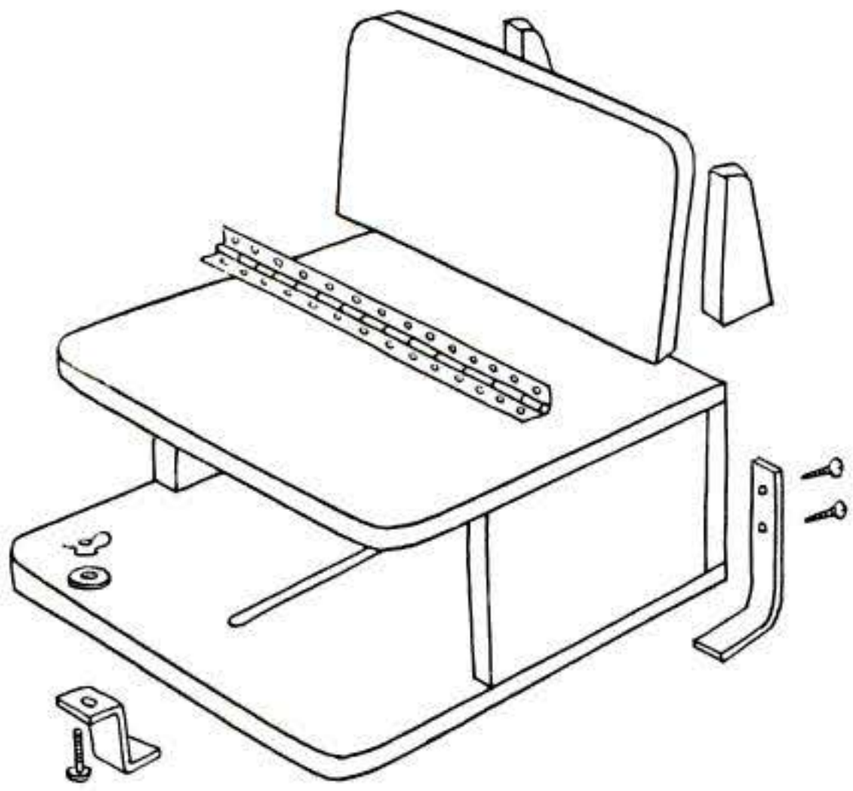
Wordless Workshop

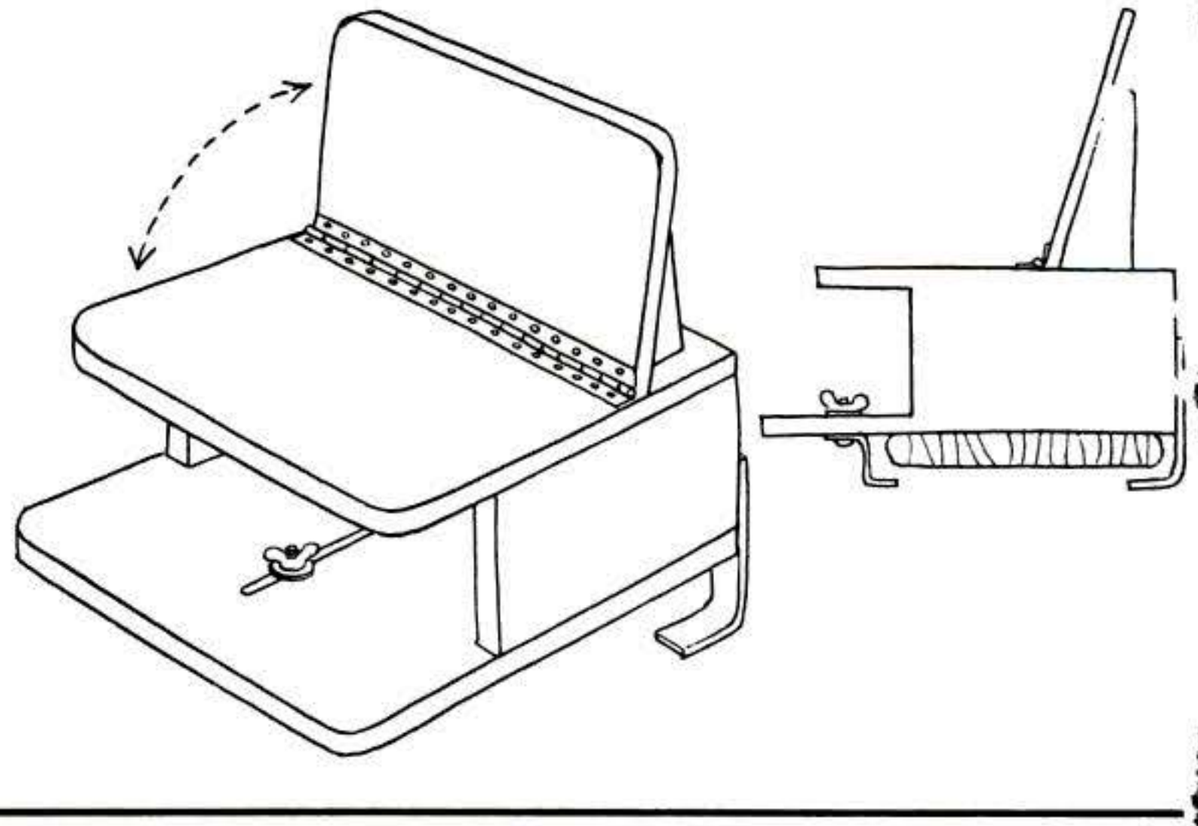
By ROY DOTY

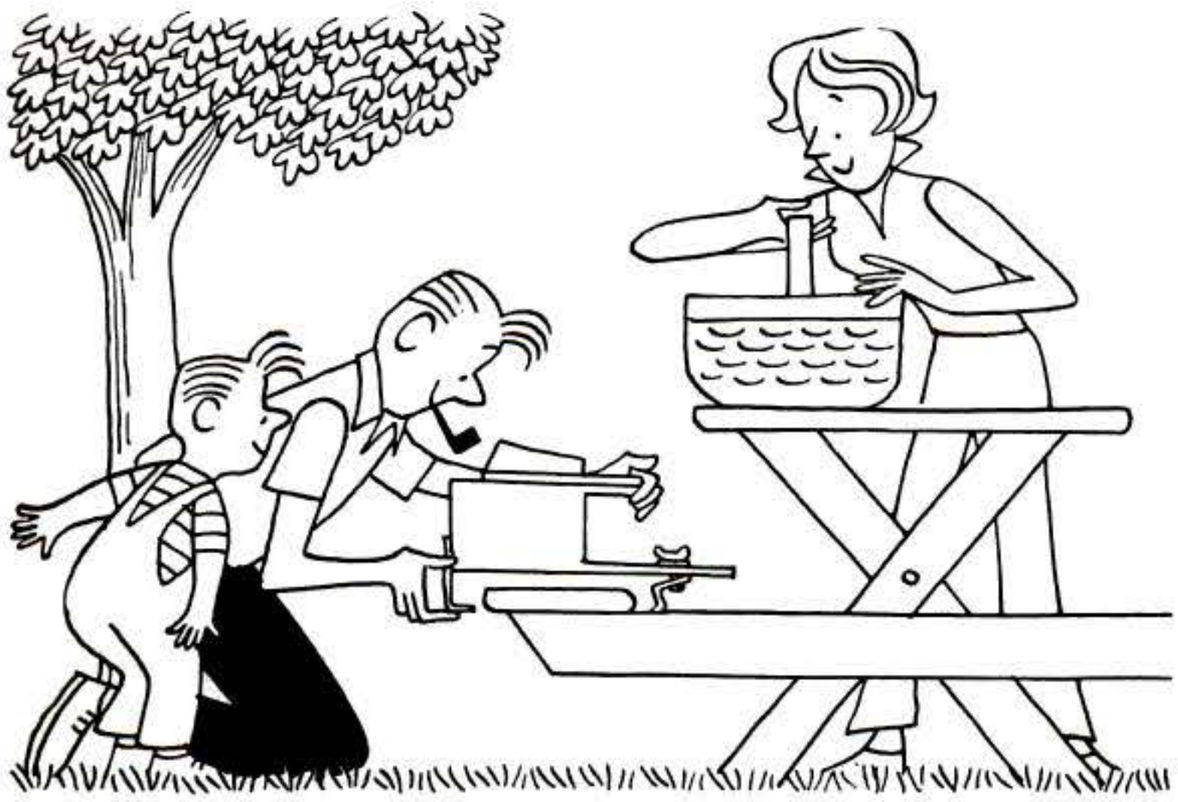












Copyrighted material

GET A LITTLE MORE IN THE NAVY

MORE OF A JOB, MORE TRAINING: The Navy can guarantee you your job (there's over 65 to choose from) or the Navy can guarantee you get to a school where you'll learn one.

MORE CHOICE—NEW 3 YEAR ENLISTMENT: You can come in for 6 years or 4 years or now, 3 years.

MORE GUARANTEES: You can be guaranteed East or West Coast and choice of sea duty or airman recruit work.

MORE TRAVEL: See Africa. See Europe. See Japan. Join the Navy and see the world. (It's still true.)

MORE BREAD: New guys now earn $288 a month. (Congress gave us a raise.)

MORE HAIR: You can wear a beard (nicely trimmed) if you want to. It's a Naval tradition; it's also a brand new Navy.

MORE FREEBIES: Besides free travel and free education and that $288 a month, you get free food and free clothing and free housing and free health care and 30 paid vacation days per year.

CALL THIS NUMBER:

800-424-8880

It's toll free and a real live Navy recruiter will answer all your questions 24 hours a day, seven days a week. In Washington, D.C. call 433-2000.

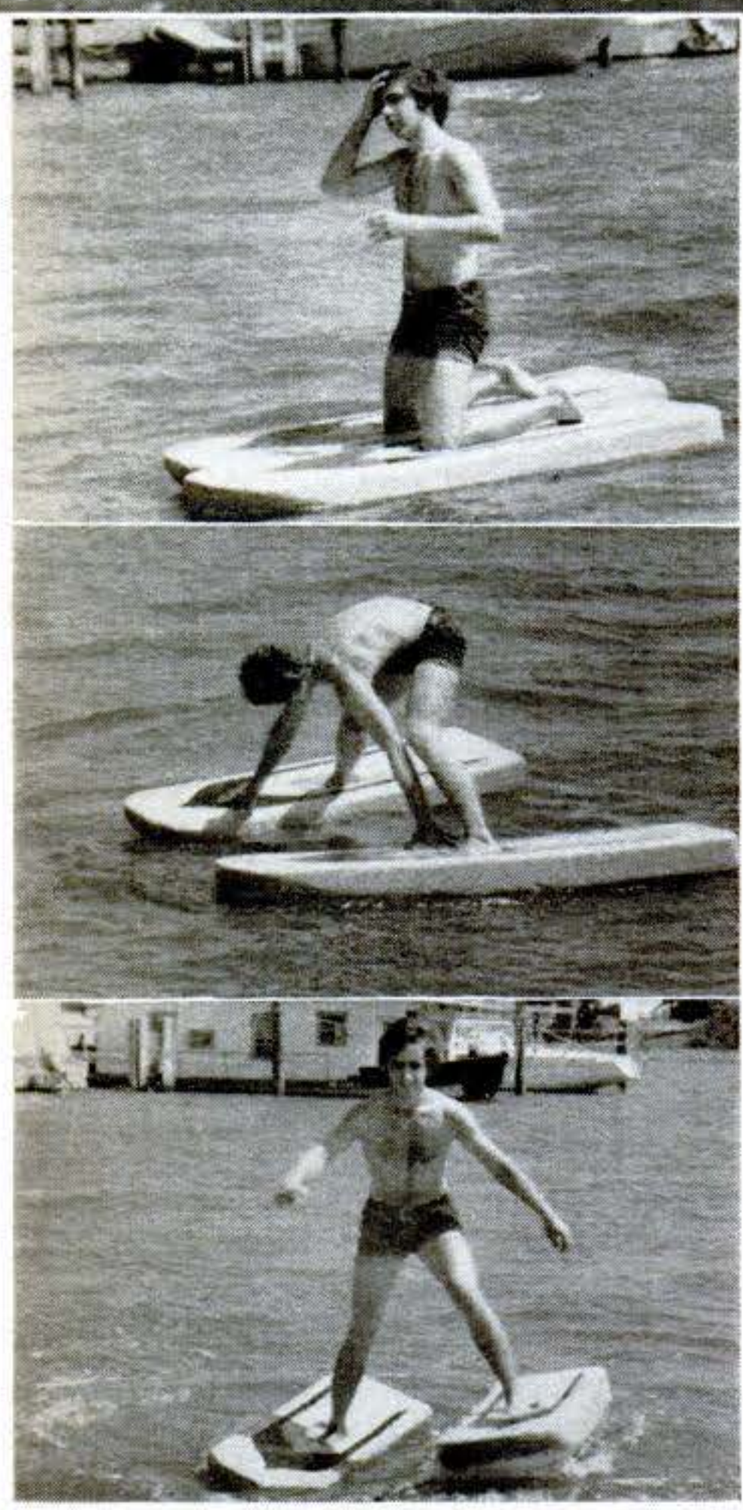
OR SEE YOUR NAVY MAN RIGHT NOW.

He's listed in your phone book under U.S. GOVERNMENT, NAVY. He's got all the answers—or he knows where to find them.

Copyrighted material

PS PROJECTS

Faith Shoes



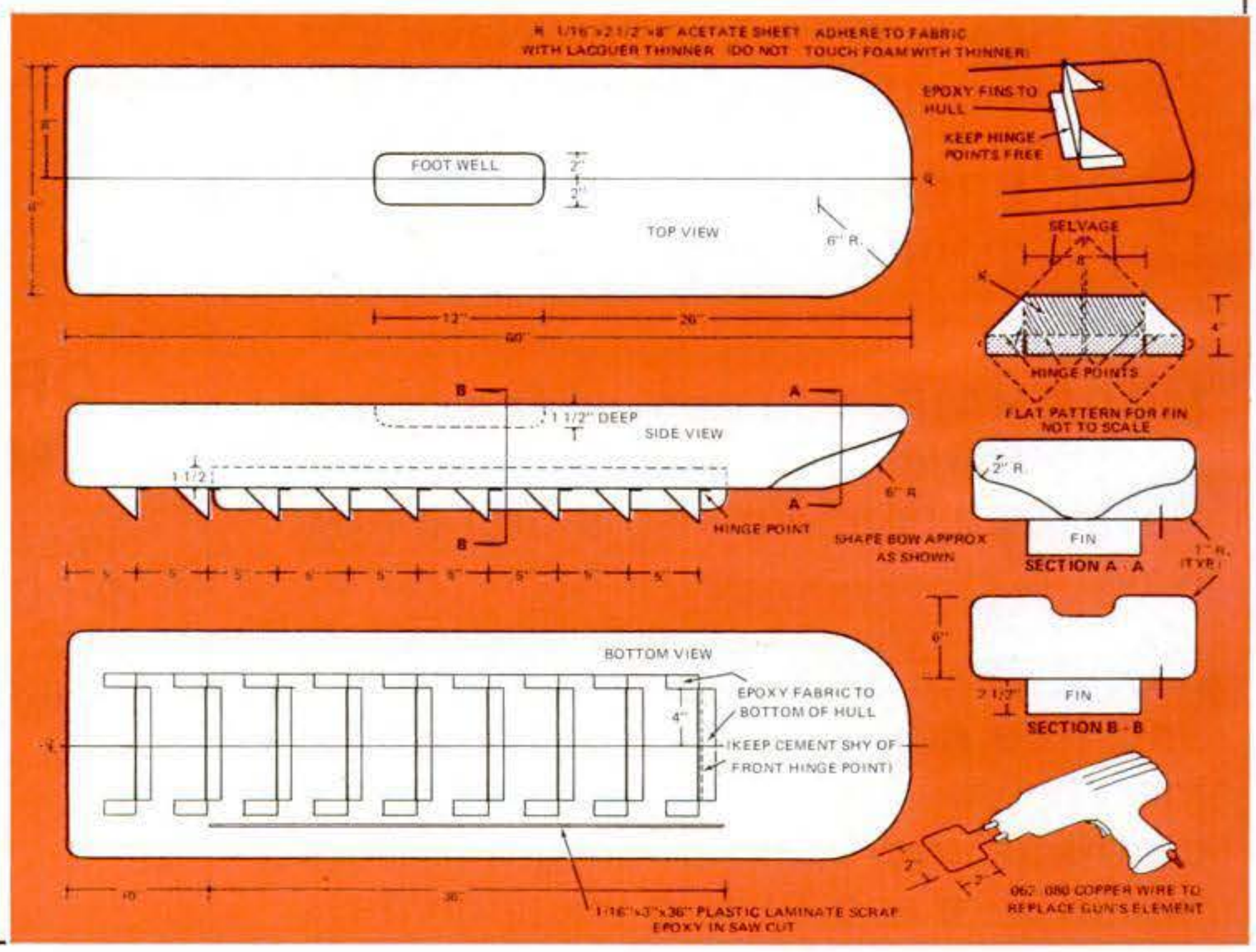
Annapolis faith: Midshipman Woodward demonstrates his father's shoes. You "board" in about three feet of water, starting on your knees, as you would with a surfboard. As you stand (center photo), there's a tendency to "spread-eagle," but you soon learn the knack of keeping your legs together. Keel boards help, here; but larger keels would make for clumsy turns. Propel yourself with shuffling step.

Yes! You can walk on water—make yourself a pair of these simple foot floats

Shape the floats from blocks of expanded (closed-cell) polyethylene foam to the dimensions shown below. I did it with a handsaw and sandpaper. Only the bow is hull-shaped; from there to the square stern, shaping is just a matter of rounding corners. Right and left shoes are identical except for the placement of the keels, which are simply epoxied into kerfs. The modified soldering-gun tool is optional; it's an easy means of scooping out the foot wells. No foot bindings are needed or recommended.

The hinged fins attached to the bottom are what make forward motion possible. They flip up to skid over the surface when you kick forward, then snap out to resist backslip as each float comes momentarily to rest. There are nine per float, and they can be cut from handkerchief-weight cotton (dacron or nylon would be even better). The pattern sketch, below, shows how to cut these from remnant strips; whether you do this or cut all fins from finished corners, note that the selvage edges should fall along the triangular sides for durability. These are the only edges that aren't anchored or reinforced.

A pair of shoes of this size will support 260 pounds; they'll be submerged about four inches. For a child, scale down the dimensions to suit. —*R. W. Woodward*



Copyrighted material

The World's Largest Ship

[Continued from page 53]

required to serve the world's growing petroleum needs; and, finally, because of the revolutionary navigational and safety equipment built into the mammoths.

Safety engineering. The most dreaded tanker catastrophes are explosion, collision, and running aground. Recent years have seen several of each and, as long as we transport oil in tankers, these hazards cannot be wholly eliminated. But the builders of the *Nisseki Maru* have gone a long way toward minimizing them.

To prevent explosions, inert exhaust gases from the ship's boilers are automatically cooled and purified, then blown into cargo tanks, reducing oxygen density in the tanks.

Special anticollision radar sounds a warning upon spotting another ship or obstacle at sea, pinpoints its location electronically and automatically charts the speed and course of moving objects.

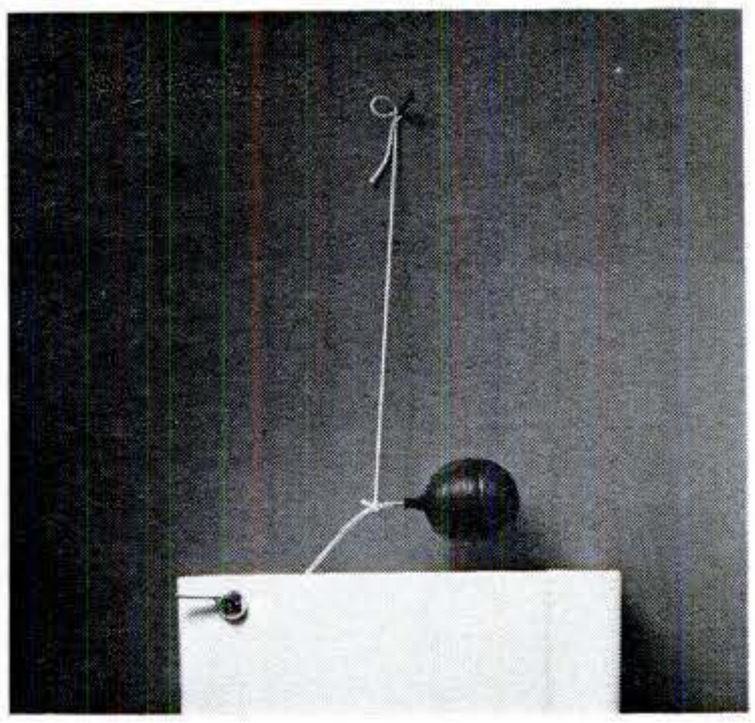
A sonar docking system uses sound waves to record the slightest movements of the ship in any direction when docking or passing through narrow waterways—a major aid in preventing the ship from going aground or hitting the pier.

Other major safety aids are a bow swing indicator (the bridge is 1,000 feet from the bow); a central, electronic pumping console for safe, balanced loading and unloading; automatic tank-cleaning equipment, and special slop tanks where oil residues are separated from the cleaning and ballast water. Only clean water is discharged from the ship.

Nisseki Maru's 40,000-horsepower turbine drives her at 15 knots. The engine, boilers, and all auxiliary equipment are directed from a central control room. In case of equipment failure, spare units take over automatically; boiler operation is monitored by television.

Comfort at sea. Everything about the ship is immense; each of her anchors weighs 24.6 tons; she wears over 300 tons of paint. She's the biggest now, but not for long; larger vessels—up to a million tons—are now under development.

Debate over the giants will go on, but this year *Nisseki Maru* will plow 120,000 miles of green water to move a billion gallons of crude. Crewmen will live in air-conditioned private rooms, eat good meals, and exercise in the recreation room, in the gymnasium, or on an open-air, nonskid jogging track around the four-acre deck—inhabitants of a mobile island that shuttles back and forth between two distant man-made depots. PS

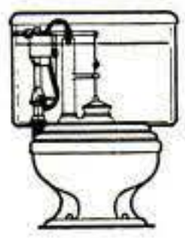


Two ways to stop toilet noise.

Leaks. Squeaks. Whines. Whistles. Ever try to live with the sounds of a leaky toilet ballcock? Some people do.

They jiggle the handle. Bend the rod arm. Even string the ornery critter up.

Millions of homeowners, on the other hand, have installed the one hydraulic device that gives toilets the silent treatment once and for all.



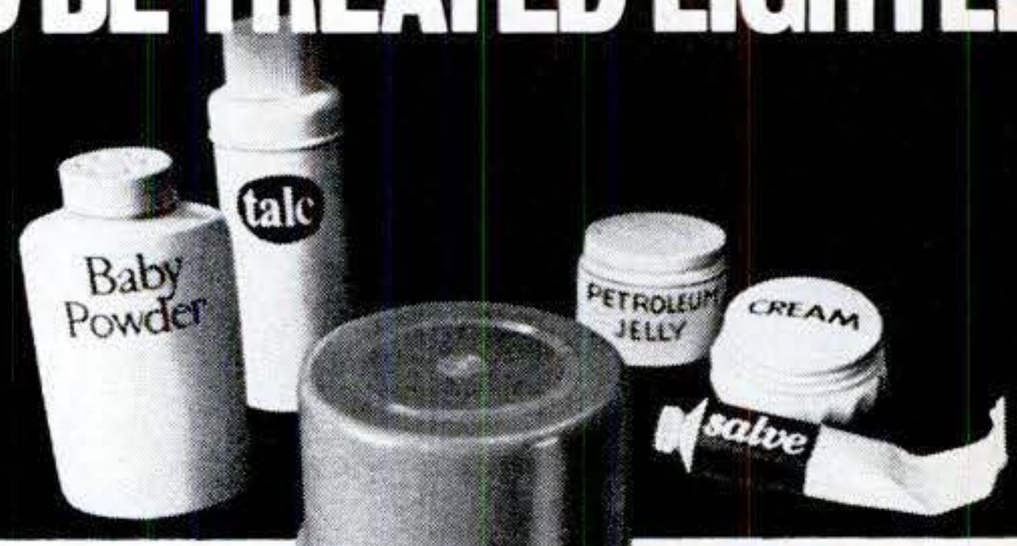
Fluidmaster.

Fluidmaster works with the water pressure. Not against it. Shut-off is fast and positive. No leaks. No squeaks. No whines. No whistles.

For full details, send for full literature today. No strings attached.

FLUIDMASTER®, INC.
1800 Via Burton
Anaheim, Calif. 92805

JOCK ITCH ISN'T SOMETHING TO BE TREATED LIGHTLY.



Jock Itch is a fungous infection. It can become serious. It can keep coming back even though you try all manner of "remedies," from baby powder to petroleum jelly.

But you can get fast relief with Cruex®, the spray-on medicated powder specifically made to fight Jock Itch.

Cruex soothes itchy, inflamed skin. Cushions against further irritation. And absorbs perspiration (an important factor in the growth of Jock Itch fungi —tinea cruris). Its medication directly attacks susceptible fungi. And because you spray Cruex on, you can reach into hard-to-get-at places and avoid the sting or burn of rubbing, dabbing, or smearing. So fight Jock Itch seriously (and help keep it from recurring) with cooling, soothing Cruex. Guaranteed to work or your money back.

CRUEX. THE MEDICATED SPRAY SPECIALLY FORMULATED TO FIGHT JOCK ITCH.

©1972 Pharmacraft Division Pennwalt Corporation

PENNWALT PHARMACRAFT

Copyrighted material

OVERHEATING? How

Troubleshoot your car's cooling system? Sure. It's easy when you know how

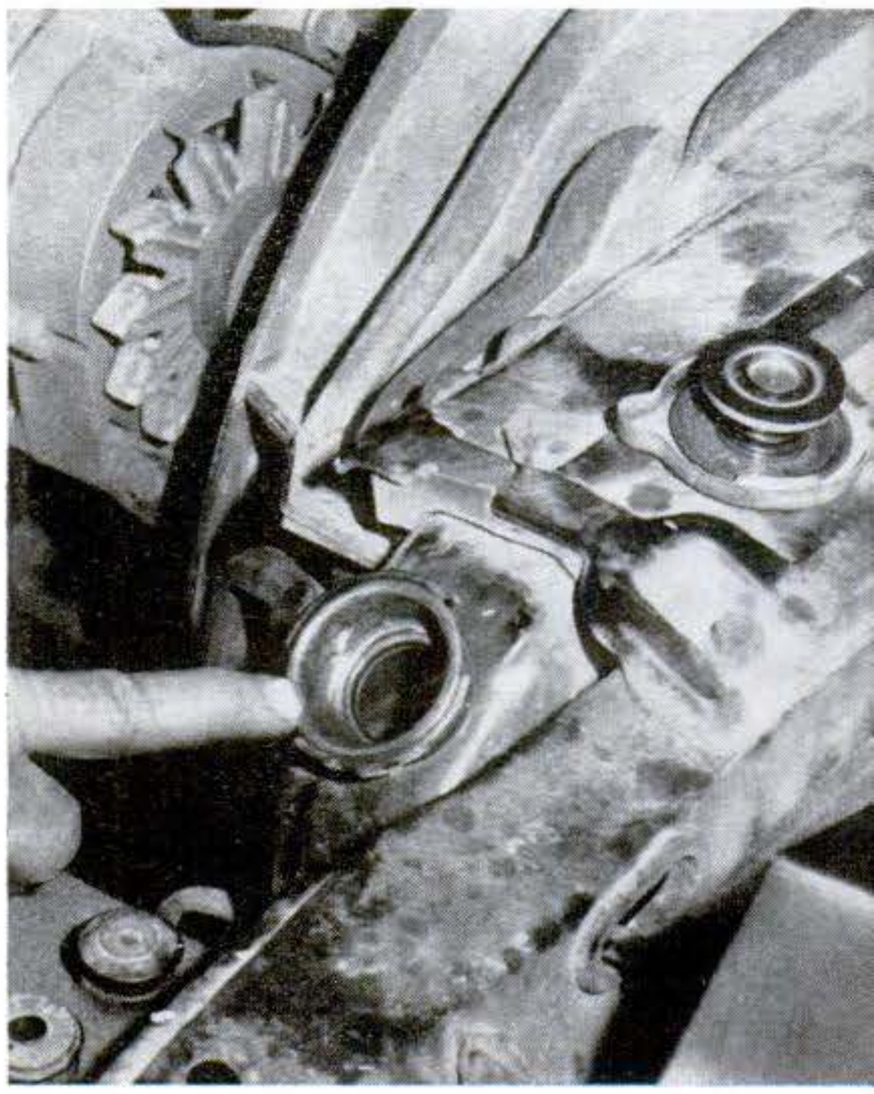
By RAY HILL

Because car makers have increased engine horsepower, decreased engine size, added hotter-running thermostats, and reduced the frontal area of the radiator to allow lower hood contours, the cooling system of your late-model car receives a substantially larger heat input, but has less radiation area to dissipate that heat. This means that, more than ever, every part of your engine's cooling system must be up to par for your engine to cool properly.

Surveys indicate that 40 percent of all cars less than two years old have cooling systems that aren't holding their rated pressures. That figure rises sharply on cars that are more than two years old, says GM's AC Spark Plug division.

What can you do to make sure your engine's cooling system isn't among the 40 percent? What can you do if your car's already seriously overheating?

A lot. You can examine your car's entire cooling system, diagnose its



If the radiator neck is distorted—or if the neck's lock ring is pulled up—the pressure cap cannot form an effective seal.

Copyrighted material

to Keep Your Cool

weaknesses, and prescribe cures.

Sound difficult? It's not. You need just one special tool—an inexpensive cooling-system pressure tester. AC makes one for $23.95; Burroughs sells one for $29.90.

The checkout procedure. First, depressurize the system by removing the radiator cap and reinstalling it. Then connect the pressure tester to the radiator neck or between the upper radiator hose and the upper radiator outlet (hookup instructions come with each tester).

Now pressurize the cooling system until its dial reads the rated pressure for your car (14-15 psi for late models, less for older ones), and watch the gauge for about 10 minutes. If the system leaks down and a no-pressure condition occurs, perform the steps in test A. If the cooling system holds its rated pressure, skip A and perform B. If you don't know your car's rated pressure, ask your gas station.

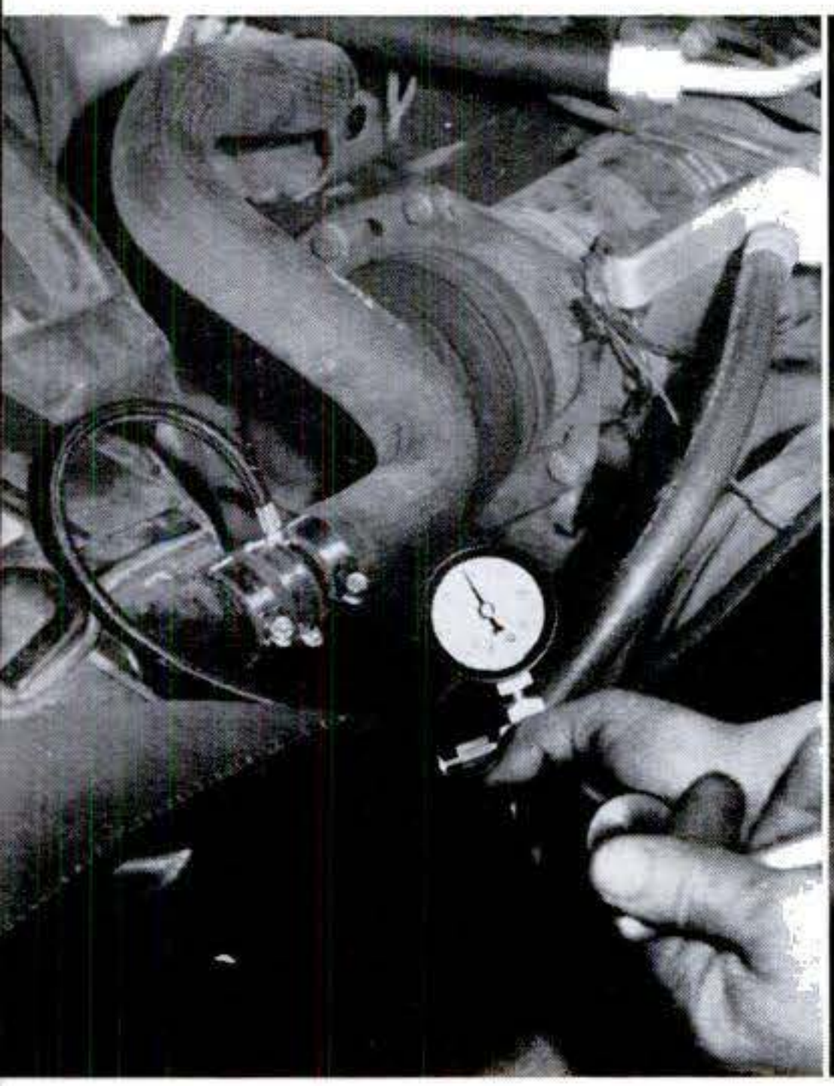
Test A:

- Check the radiator neck's lock ring. Make sure it's not pulled up, preventing the radiator cap from sealing at the neck's base.
- Inspect the upper and lower radiator hoses, and all other water hoses, for cracks and faulty connections—replacing and tightening if needed.
- Check the thermostat-housing gasket to make sure it's not leaking.
- Screw the radiator cap into the tester and pump it up to 14-15 psi. If the cap's good, the needle in the tester gauge will hold steady. If it's bad, the needle will drop.
- Check the water pump to make sure it's not leaking. If it's leaking at the gasket, replace the gasket. If the water pump itself is leaking, you'll have to replace the pump.
- Inspect the radiator for leaking solder seams and other damage. If it's leaking only slightly, pouring in some radiator sealant may stop the leak. Otherwise, you'll have to take it to a radiator shop for repair.
- Check the cylinder-head gasket. If leakage is suspected, blow compressed air into the cylinder with the piston at top dead center on the compression stroke. If it's leaking around that cylinder, you'll see air bubbles in the upper radiator hose.

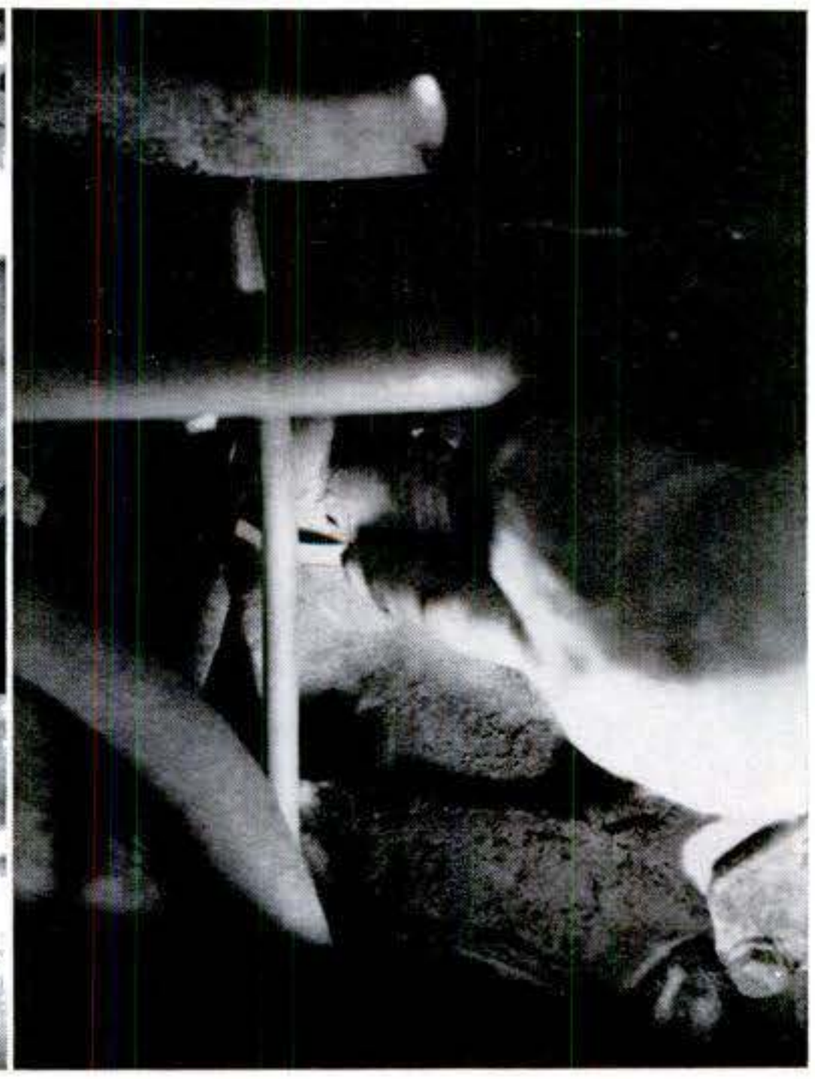
Test B:

- Look for obstructed airflow through the radiator (bugs, leaves, and so on).
- Check coolant level. In some cases, bringing the coolant level to the full mark (with the engine running and the thermostat open) has cured some engines. Because a hot engine will tend to develop pressure and try to force the fluid out, fill the radiator as soon as the thermostat opens.
- Check initial ignition timing. Retarded spark can cause excessive engine heat.

Continued



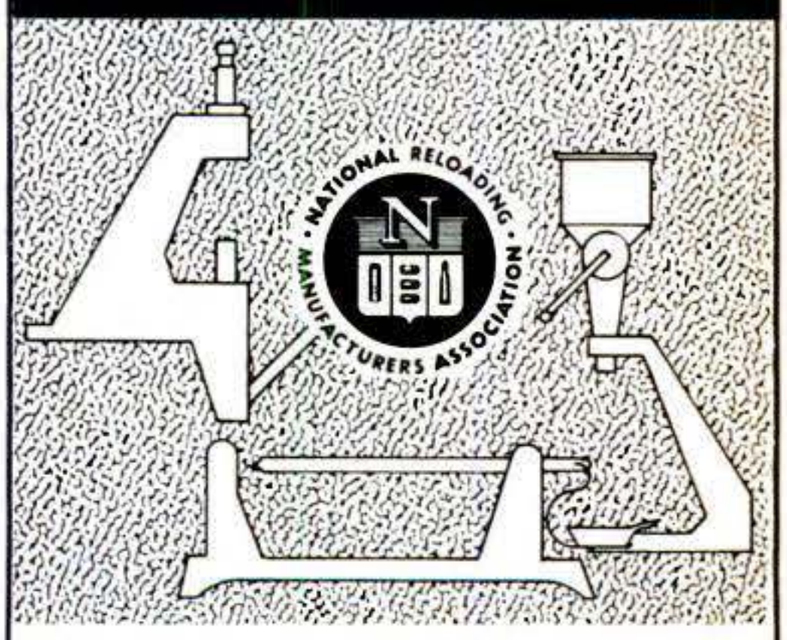
Attaching the pressure tester between the upper radiator hose and upper radiator outlet lets you pressurize the cooling system.



Tighten any water hoses that are loose. If a hose is cracked, or is soft and collapses easily when squeezed, it should be replaced.

HANDLOAD!

IT'S EASY, IT'S FUN!



Economy is but one of the advantages reloading offers the American shooter. The pleasure of a fascinating hobby, plus "tailor-made" loads for your particular guns are equally important. Reloading allows you to shoot much more for the same cost.

As no two fingerprints are the same, no two guns shoot the same. Factory ammunition, that shoots well in one gun, may not shoot as well in another. This is the primary reason that thousands of shooters begin reloading each year.

When you reload with CCI primers, you get the added bonus of uniform performance, dependability and accuracy. Go ahead. Start handloading now and be sure and get the right start with CCI.

FOR "PRIMER BOOKLET"

SEND 25¢ TO:

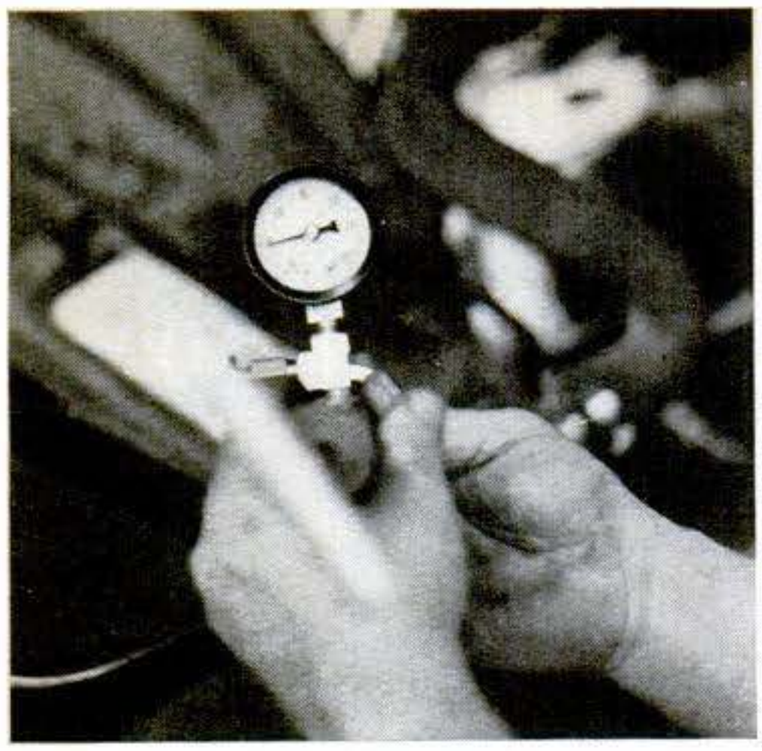
CCI OPERATIONS

Dept. PS72, Box 856 Lewiston, Idaho 83501

OMARK INDUSTRIES

Sporting Equipment Division

Copyrighted material



A pressurized cooling system should be able to hold 14-15 psi. If it can't, it's leaking. You can find the leak with the tester.

• Check antifreeze mixture to make sure it's at the −20-degree protection it should be for proper cooling and proper temperature-light operation. The engine coolant warning system is designed to warn you of an overheating condition at approximately 10 degrees below the coolant's boiling point. With glycol content less than the −20-degree mark, the boiling point is less than the temperature light's setting, and a loss of coolant could result without the warning light ever flashing on.

• Check fan-clutch operation. If you suspect the clutch is defective, replace it.

• Check the thermostat. With a cross-flow radiator, thermostat operation can be determined by removing the radiator cap when the engine is cold and observing the coolant in the right radiator tank. When the engine is started and allowed to run until it reaches normal operating temperature, one of the following conditions will exist:

If the thermostat's operating normally, coolant level will remain fairly constant until the engine approaches normal operating temperature. Then the coolant level will drop noticeably (when the thermostat opens) and the coolant will flow slowly from the exposed radiator tubes.

If the thermostat's stuck closed, coolant level will not drop when the engine reaches normal operating temperature and no coolant will be observed flowing from the exposed tubes. This will cause the engine to overheat.

If the thermostat's stuck open, the coolant level will drop as soon as the engine is started and the coolant can be observed flowing slowly from the exposed tubes when the engine is cold. Also, the engine will not reach its normal operating temperature without a load.

• Check the fan belt. It should be tight. If you find that it's frayed or worn, replace it.

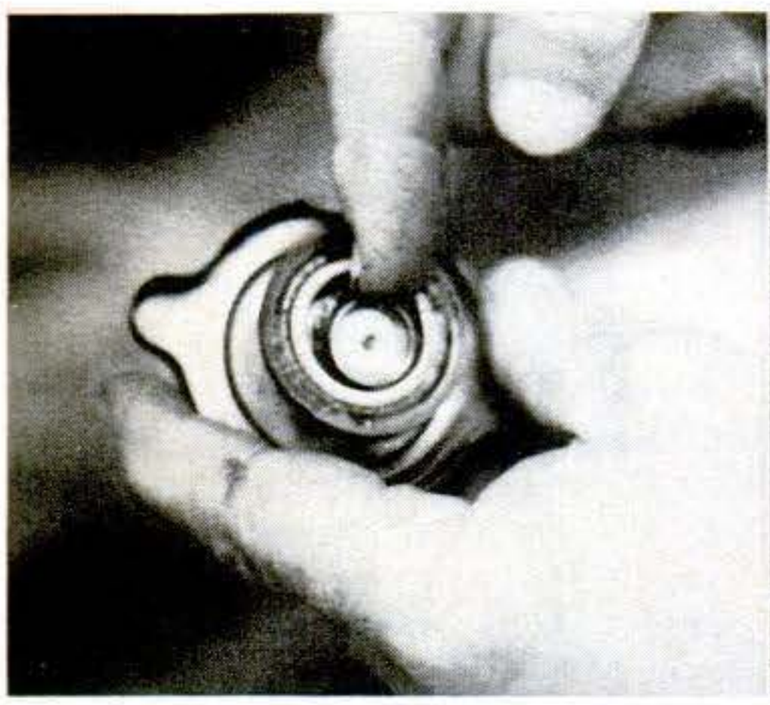
Clean out rust and scale. Over a period of time, these can accumulate in the radiator and engine water jackets —restricting water circulation and causing the engine to overheat. If you have this problem, the water will appear rusty and muddy.

By draining all the water from the cooling system and measuring how much it takes to fill it again (comparing it with the cooling system's rated capacity), you can get a pretty good idea how much rust is inside.

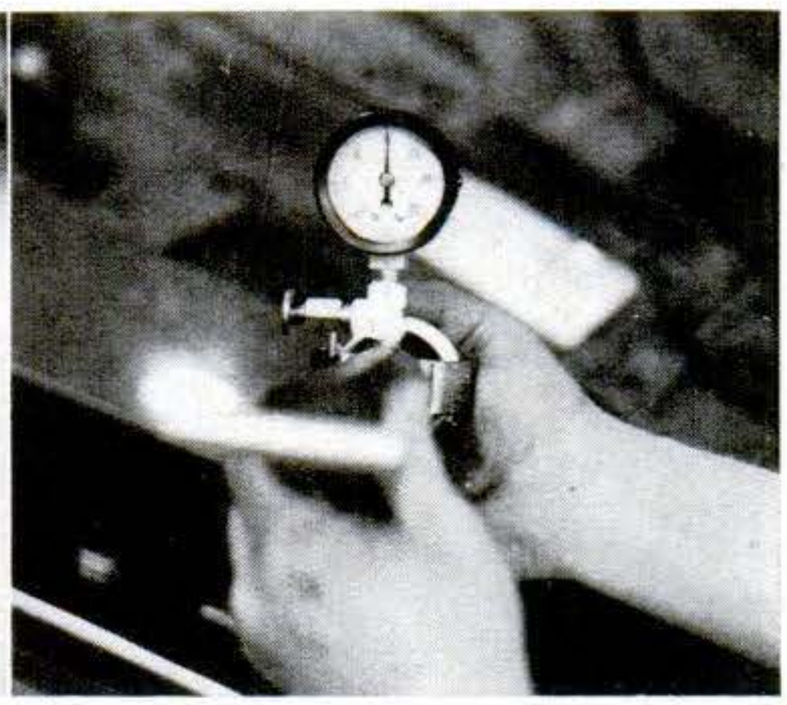
To see if the radiator's clogged, remove the radiator hoses and shoot a stream of water from a garden hose into the top of the radiator. If the radiator is clear, the water will run freely through the radiator without filling it up. If the water runs slowly and the radiator begins to fill, the radiator's clogged.

To find out where the clogged areas are, reconnect the hoses, fill the cooling system, and start the engine, letting it warm. Turn the engine off and feel the radiator with your hand. Cold spots indicate sections that are clogged.

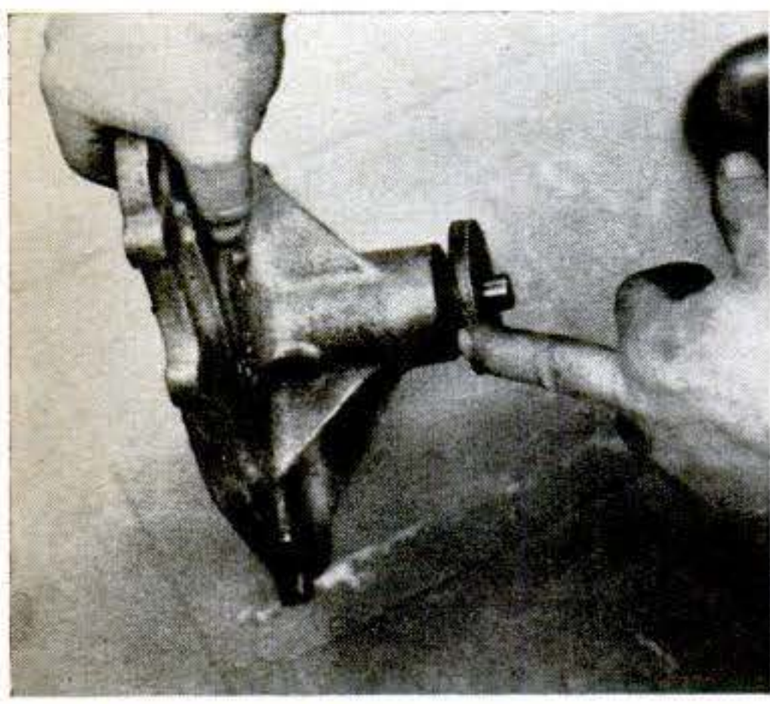
To remove the rust and scale, first drain all the water out of the cooling system. Then stick a garden hose in the radiator neck, and flush out the system. If your garden hose won't build up enough pressure to flush out the accumulated rust, you'll have to go to a radiator shop and get the job done. PS



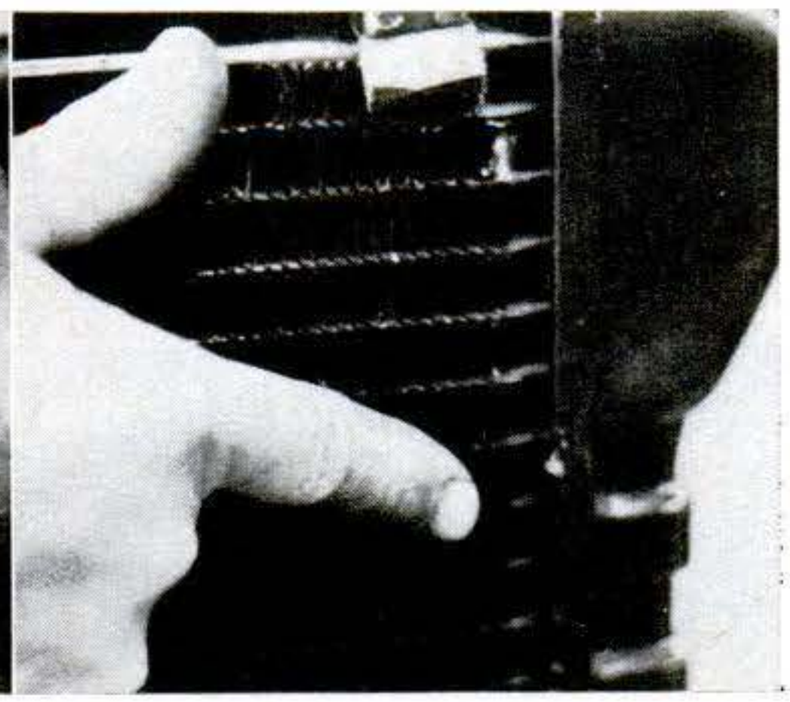
If the pressure cap's bad, before throwing it away check to make sure no foreign matter is inside, preventing a good seal.



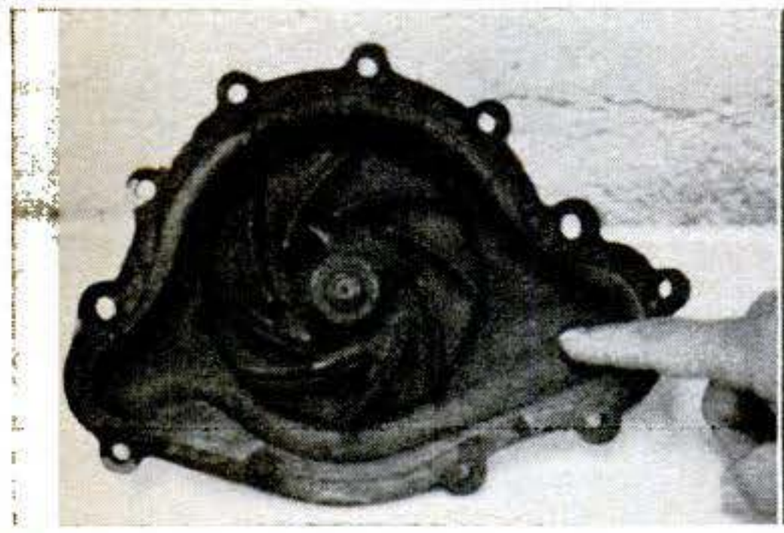
If the radiator cap can't hold 14-15 psi, replace it. The pressure cap is one of the most common items to need replacement.



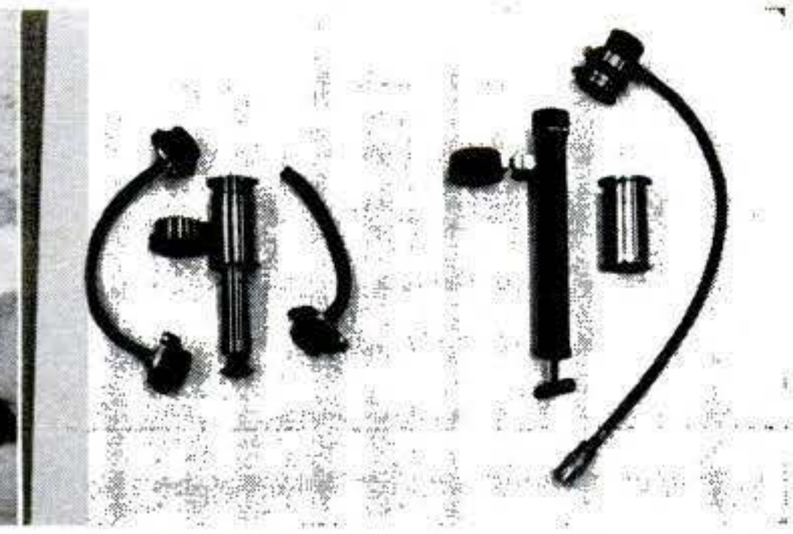
If the water pump is leaking from a crack or from the seal, there's no fix except buying a new one and installing it.



Very small holes in the radiator may be plugged by adding radiator sealant. The bigger ones will have to be soldered.



Because of a casting defect, an extra piece of metal is sometimes found inside the water pump, restricting the water flow.



Pressure testers: AC unit (left) is $23.95; Burroughs unit is $29.90. They're available through automotive-parts stores.

Copyrighted material

New See-in-the-Dark Scopes

[Continued from page 68]

and obliterate what you see in the eyepiece. The newest scopes, with microchannel plates, have no blooming problem.

These plates begin much like fiber-optic disks: I watched hollow glass tubes being stretched and bundled until tube channels were 10 microns in diameter. The microscopic pipes are fused together, then sliced. The inner surface of all channels in a thin slice is coated with a material that emits secondary electrons when struck by electrons from the photocathode of a tube (see diagram). Electrons entering channels are accelerated by up to 1,200 volts across the plate; one electron can multiply to 10,000.

The output phosphor screen is placed directly behind the plate. Since individual channels help control light gain, a bright light will not ruin the image. Most of the gain is achieved by multiplying electrons, not accelerating them.

Flattening intensifier tubes. Using *proximity focusing*, both first- and second-generation intensifiers can be made wafer-thin. Components—photocathode, phosphor output screen, or microchannel plate—are spaced thousandths of an inch apart. Fiber optics again transfer images into and out of these devices, called proximity-focused diodes.

When an intensifier scope feeds an amplified light image into a camera, less than one-fifteenth of the light reaches the film. The intervening lenses lose most of the light.

At Bendix I saw an ingenious technique to avoid this light-loss problem: put the intensifier—a wafer-thin diode—inside the camera. The fiber-optic disk, in contact with the film, transfers all light from the phosphor surface to the film.

Intensifiers as shutters. One experimental Bendix camera, a modified Mamiya Universal (see photo), uses an amplifying diode with a gain of 30. Other cameras, using microchannel diodes, have been assembled with gains of 25,000. Film speed is calculated by multiplying film ASA by the intensifier gain. Intensifiers can also serve as electronic shutters, turning on only long enough to expose the film correctly.

Can you obtain intensifier scopes? Generally, manufacturers restrict sales to law-enforcement agencies and other organizations; an exception is a discontinued Raytheon model offered by Edmund Scientific Co. Scope prices are steep: $2,300 to over $6,000. Now that the military secrecy lid has been lifted further, though, civilian applications may develop. PS

Sun Clock Tells Right Time

[Continued from page 101]

south of the base and facing north, I placed the clock on the base, and then raised its left edge. How much? Simple—enough to throw the horizontal east-west axis of the clock six deg. 43 min. off horizontal. It's easiest to measure this angle along the top edge of one of the arrow support bars.

If I lived six deg. 43 min. to the east of the standard meridian, I would have tilted the clock the same amount, but with the *right* side raised. Once you've found the proper angle, use shims under the mounting bracket and bolt the clock unit in place.

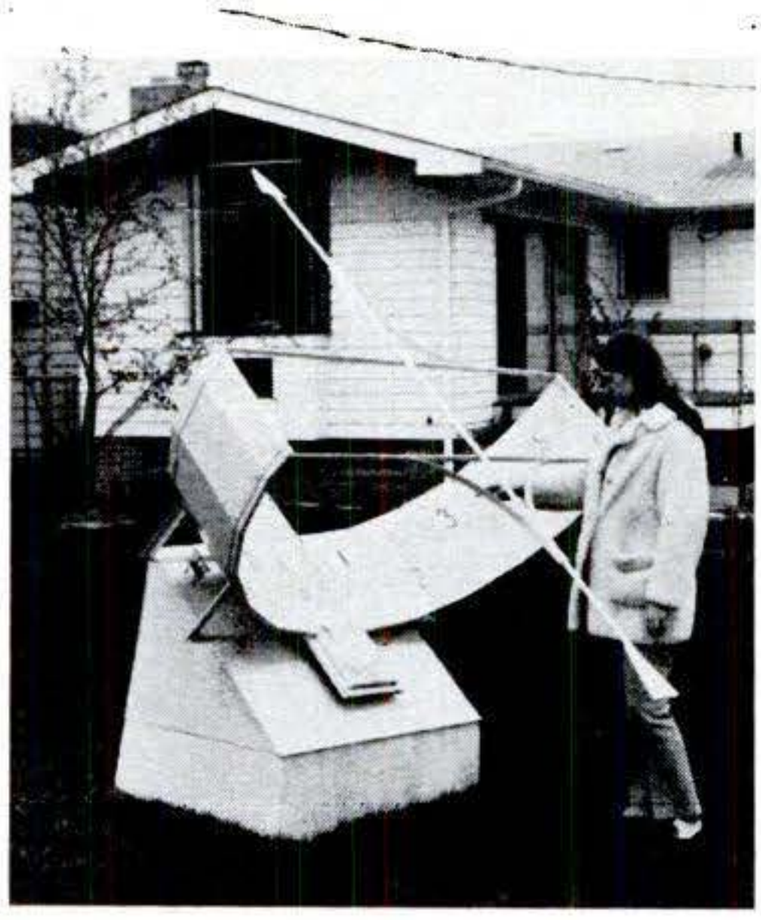
Finishing and numbering. Paint the clock any color. I used white for easy-to-read contrast with my numbering, which was in blue and black.

When the paint is dry, mark off the hour boards. For simplicity's sake I broke my hours into five-minute units. Remember that the hour marks for all hours but 6 a.m. and 6 p.m. go in the center of the boards. Since the two six o'clock boards are half-width, their hour marks go at their uppermost edges.

Adding the analemma. If you've built your sun clock to my dimensions, copy the analemma that appears earlier by transferring it to a grid of 1″ squares. If you build a clock one-fourth the size of mine, just clip the analemma out of the magazine.

Where do you position it? Make sure its long axis is directly on the noon hour mark. And make sure the centerline (running across the analemma near the September 22 mark) is directly over the center of the 36″-long noon hour board.

That's it; your clock is finished—all set for a lifetime of time-telling. Provided the sun shines. PS



Large size gives the clock greater accuracy and impact, but you can scale it down if you like, following hints given in text.

Copyrighted material

Sneak Preview of the '73 Models

[Continued from page 83]

PLYMOUTH SATELLITE gets extensive front-end treatment for '73 but retains same wheelbase, same basic body.

CHRYSLER is fundamentally unchanged but gets a face-lift with a certain amount of Lincoln-Mercury inspiration.

Pontiac, and Olds. The name Chevelle will be downgraded when the plush Laguna is introduced. The top Le Mans will be called Grand Am.

The 1973 cars will be quieter inside and out. Exhaust controls that recirculate burned gases back to the combustion chamber will be used on all cars—and may worsen the already poor drivability of some engines. Electronic-ignition systems will spread across the board at Chrysler and pop up in more GM cars. Convertibles will be dropped from the big Ford lines and GM intermediates. The hatchback or three-door body style will spread to American Motors, and GM will add this type of body to its compact lines.

Here are the major surprises the auto makers are preparing:

General Motors. Top prize in the styling sweepstakes goes to GM's intermediate lines, including Monte Carlo and Grand Prix. Four body styles will be offered—the two-doors, a four-door, and a wagon—and not one is a hardtop. All have the old-fashioned B post—making a comeback as a safety feature. It forms the main roof support and helps prevent collapse in rollover accidents. A Ford official remarked recently, "GM will get clobbered if they drop the hardtop." I'm certain he had not seen these cars; he's sure to eat his words.

GM insiders are excited about the top cars in their intermediate lines. Each is claiming the best styling on the road—Chevy boosting its Laguna, Pontiac its Grand Am, Olds and Buick their notchback coupes.

The two-door fastback versions have push-out rear windows instead of the roll-down type. Four-door bodies have a special greenhouse area known as a "six window" design (the windows behind the rear doors make a total of six side openings).

GM's midsizers have the same 112- and 116-inch wheelbase as present models, but bumper extension has raised overall length four inches.

Since the Monte Carlo and Grand Prix are built on the intermediate chassis, they get the redesign treatment, too. Both cars are dramatically changed in appearance.

The MC now has the typical Chevy grille, a wide rectangle split in the middle by the bumper. From the side, the fenders are longer and not so boxy as on the 1972. An opera window has been added to the C post.

Grand Prix styling has a similar approach. The front end is traditional Pontiac. From the side, the car presents a new shape. The outstanding feature is the stretched-out roof line that ends about 12 inches farther back. The opera window provides daylight for rear-seat passengers as a substitute for the side roll-down.

GM plans to use the telescoping shock-absorber units in the bumper systems of both full-size and intermediate cars. These will retract up to three inches on impact, then return to their normal position, and can be used over and over without damage. On the smaller cars, GM uses a variety of systems, including spring steel and plain beefed-up steel, to take the shock of impact. The difference in designs is traceable to one immutable fact of physics: The heavier the car, the more energy must be absorbed in a five-mph crash. On lighter cars, simpler systems are usable.

A significant change will take place in GM's compact lines. Olds will introduce its new Omega model in two- and four-door body styles, and be the first division to show the new hatchback coupe—a takeoff from the two-door GM X body. In appearance it differs little from the two-door Nova and Ventura II except for the grille. Chevy and Pontiac are also scheduled to pick up this model in 1973.

Little has been done to change the styling of GM full-size cars other than to alter the grilles and add the heavier bumpers. All changes are aimed at carrying over the identity of the cars. Look for Camaro, Firebird, Vega, and the high-priced specialty cars like Toronado and Eldorado to remain pretty much the same, too, while Corvette's shark nose will be blunted and capped by a heavier bumper.

Emission controls on all cars will include an exhaust-gas recirculation valve next year. This device takes part of the engine exhaust and reroutes it back to the combustion chamber for reburning. The purpose is to cut down on emissions of oxides of nitrogen—the real culprit in creating smog. When exhaust gases are recycled to the engine, the temperature of combustion is lowered, and this cuts NO_x emissions.

Engineers predict that this new device will adversely affect drivability even more on the new cars than on the 1972s. Hard starts, uneven running, stalling and stumbling, running on, lower horsepower, and poor fuel economy are complaints that have grown more frequent since the 1972 emission controls were installed.

Ford. They'll change the sheet metal on the big Ford and Mercury lines as a major styling change. Other made-in-Dearborn models will have, at the most, revised grille work and bumpers.

The big Fords have much sharper styling lines in the body, but, overall, are easily recognizable as Ford products. They will offer a novel windshield washer that sprays fluid directly from the wiper blade to the glass, thus assuring more coverage for the fluid. Stronger trunk locks will be added to the big cars, and a security package that includes spare-tire and hood lock will be offered—first time.

Inside, the big Fords have been changed too. A large-capacity glove box, three times larger than the present one, is the result of major changes in positioning behind-the-panel components. All Ford products will have an inside hood release to protect against thieves.

Mustang and Cougar will be the only Dearborn lines to offer convertibles. The soft tops will be dropped from the LTD and Marquis lines as

a concession to safety. A special grille for the top Mustang model will set that model apart. Bumpers are body-colored, and do not appear as massive as on other 1973 cars.

A slick new disappearing vent window will be an option on the full-size cars. This vent does not pivot outward, but drops down into the door. When the door glass is also rolled down, the opening has the same clean look as ventless styling.

Virtually unchanged in appearance and features are the Maverick and Pinto. A slightly deeper section bumper has been added to the front of each car, and special mag-type wheels will be made an option. A major change was made in the front end of the Torino to flatten the grille. This was forced by the new bumper restrictions, a rare example of the need to change an existing grille to conform with bumper standards. The Torinos are about three inches longer with their new front bumper system.

Most Ford Motor Co. cars will have a unique rubber-puck energy-absorbing system for front bumpers [PS, July '71].

Chrysler. Chrysler concentrates on engineering for its 1973 features, while styling changes are held to a minimum. Best-practical-change honors—aside from the new bumpers on all new cars—go to Chrysler for making electronic ignition standard equipment on all its engines. The system is virtually impervious to moisture, provides high voltage for much longer periods, and needs little maintenance during the car's life.

Chrysler has also cut down on noise by adding better sealers around the windows and more mastic padding on the floor pans. Exhaust systems now are double-walled and mufflers revised so that no car will exceed 84-db noise levels when run at wide-open throttle.

Charger has a new grille and new C-post treatment that includes a louvered opera window. A special "super quiet" Charger has all the soundproofing used in the bigger cars. The Newport has a new grille, hood, and grille panel. Similar changes are made in the other lines, including Dart and Valiant. Sheet-metal changes may be the least extensive since WW II, but every car in the Chrysler line-up has some change to set it apart from the 1972s.

In a return to a design from the past, optional vent windows will be offered on all full-size cars at extra cost. These will be manually operated and conventional in design, not like Ford's disappearing ones.

Chrysler will use a new thermosetting enamel on the body exteriors as the color coat. The material has two major benefits—one for the company, one environmental. With the new paint, only two color coats need be applied, instead of the present three; but the paint thickness remains the same. Emissions from the paint booths and ovens are non-photochemically reactive and conform to the Federal Ambient Air Quality Act.

On Demon and Duster models, a fold-down rear-seat package will be offered as an option. With the seat down, a flat floor space of about 6½ feet front to rear is provided behind the front seat.

Chrysler will make disk brakes for front wheels standard equipment on all cars except six-cylinder Darts and Valiants. Most Chrysler vehicles equipped with air conditioning will have radiators with increased frontal area. Changes have been made in the radiator fan to provide better cooling in the bigger V8 engines. Reduction of from 10 to 25 degrees in coolant temperatures results from the new fan. Finally, Chrysler is installing a closed cooling system on a number of 1973 engines, with a four-quart reservoir made of translucent plastic for easy checking of the coolant level.

American Motors. The smallest company has been making important gains in the marketplace, due more to its Buyer Protection Plan than to any major change in its products.

However, at the same time BPP was installed, AM stepped up efforts to boost the quality of its vehicles. This year you will see even further improvements. Car styling is almost identical to 1972, though a new hatchback model is being introduced in the Hornet line. The new bumpers stick out about three inches from the grilles and have a protective strip of rubber running the full width.

It's an old truism that the fewer changes you make in a car from year to year, the better the quality. At American Motors, where quality has been rising steadily, the 1973 models should be outstanding. The Hornet hatchback, unlike similar models planned for GM compacts, has a special roof design with more of a fastback appearance than the Hornet two-door sedan. Inside, rear seats will fold forward to form a long, fairly flat area behind the front seats.

That sums up the major features of the 1973 cars—cleaner, safer, less fragile in a crash. Unlike past years, when styling was the biggest news, the present approach is in tune with what the buyer wants. PS

Fix it to stay fixed with
LOC-KIT®
positive lock washers

Use on nut and bolt joints in:
- Appliances
- Lawn and garden equipment
- Automobiles, snowmobiles, boats, bicycles, motorcycles, ATVs and off-the-road vehicles
- Toys
- Furniture
- Shop equipment—power and hand tools

Hundreds of home and shop uses.

Even extreme vibration will not loosen nut and bolt joints "locked" with
LOC-KIT
positive lock washers
Get them at automotive, hardware and other retail stores. 372-34

BE A LOCKSMITH

"While in training I earned $200 . . . now have a mobile unit . . . it was best instruction one can get." Orville Pierce LaPuente, Calif.

KEY MACHINE locks, picks, tools supplied with course.

You'll EARN MORE, LIVE BETTER Than Ever Before in Your Life

You'll enjoy your work as a Locksmith because it is more fascinating than a hobby—and highly paid besides! You'll go on enjoying the fascinating work, year after year, in good times or bad because you'll be the man in demand in an evergrowing field offering big pay jobs, big profits as your own boss. What more could you ask!

Train at Home—Earn Extra $$$$ Right Away!

All this can be yours FAST regardless of age, education, minor physical handicaps. Job enjoyment and earnings begin AT ONCE as you quickly, easily learn to CASH IN on all kinds of locksmithing jobs. All keys, locks, parts, picks, special tools and equipment come with the course at no extra charge. Licensed experts guide you to success.

Illustrated Book, Sample Lesson Pages FREE

Locksmithing Institute graduates now earning, enjoying life more everywhere. You, can, too. Coupon brings exciting facts from the school licensed by N. J. State Department of Ed., Accredited Member, Natl. Home Study Council. Approved for Veterans Training.

LOCKSMITHING INSTITUTE
Div. Technical Home Study Schools
Dept. 1111-072, Little Falls, N.J. 07424

LOCKSMITHING INSTITUTE, Dept. 1111-072
Little Falls, New Jersey 07424 Est. 1948
Please send FREE illustrated Book—"Your Big Opportunities in Locksmithing," complete Equipment folder and sample lesson pages—FREE of all obligation—(no salesman will call).

Name .....
(Please Print)
Address .....
City/State/Zip .....
☐ Check here if Eligible for Veteran Training

Copyrighted material

SHOP TALK

By ROBERT P. STEVENSON

Want to build (and run) your own carnival?

It's a long time since I've encountered anything with as much potential for fun and profit as this new catalog of plans for building your own carnival or circus rides. You can get the catalog by sending a dollar (refundable with the first $10 order) to A. B. Enterprises, Box 875, Peoria, Ill. 61601. The catalog was compiled by A. K. Brill, who has been building such rides since 1941. Besides plans for all sorts of rides, Brill also will sell you patterns for casting animals for your own merry-go-round. No need to keep rides in your own backyard, either. Set one up at the local supermarket, and get all the shopping mamas and kiddies as paying customers.

You can now get plans for Plexiglas projects

Our friends at the Rohm and Haas Co. are now offering five project plans, at 50 cents each, for making useful and decorative home items from Plexiglas. The projects include a telephone table, cube table, wine rack, picture frame, and an etagere (tier of open shelves). Order from Projects of Plexiglas, Box 14619, Philadelphia, Pa. 19134. An instruction booklet comes free with the plans.

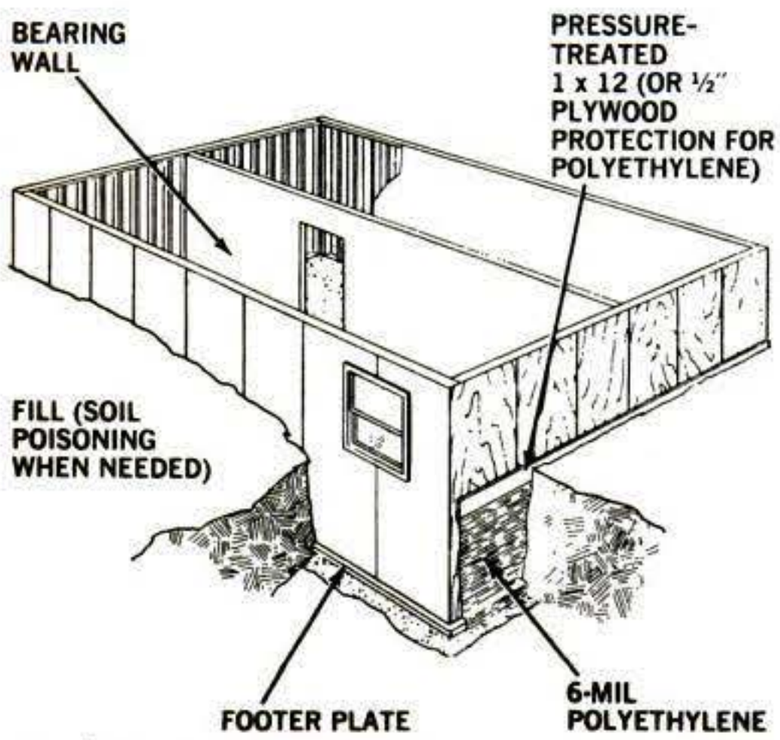
Government publications available at regional bookstores

Depending on where you live or work, you may be able to visit one of the regional retail bookstores where the Government Printing Office now sells some of its most popular home and garden publications. Previously, these have been available only by mail from Washington. In addition to five stores within Washington, D.C., regional stores are located as follows: *Atlanta*, Room 100, Federal Bldg., 275 Peachtree St. NE; *Boston*, Room G25, Federal Bldg., Sudbury St.; *Chicago*, Room 1463, Dirksen Bldg., 219 S. Dearborn St.; *Dallas*, Room 1C46, Federal Bldg., 1100 Commerce St.; *Denver*, Room 1421, Federal Bldg., 1961 Stout St.; *Kansas City, Mo.*, Room 135, Federal Office Bldg., 601 E. 12th St.; *Los Angeles*, Room 1015, Federal Office Bldg., 300 Los Angeles St.; *New York*, Room 110, 26 Federal Plaza; *Pueblo, Colo.*, Documents Distribution Center, Pueblo Industrial Park; *San Francisco*, Room 1023, Federal Office Bldg., 450 Golden Gate Ave.

Do your home locks make it easy for burglars?

A statement from Quinn Tamm, executive director, International Assn. of Chiefs of Police, says "perhaps the reason burglary is so popular is because we make it so easy. Do yourself a favor—make burglary difficult." The statement is contained in a small folder, *How to Protect Your Home and Family Against Burglary*. You can get it free from Kwikset, 516 E. Santa Ana St., Anaheim, Calif. 92803. Kwikset says that home locks five years old are probably outmoded.

Build a home on a wood foundation? Now you can



Instructions and plans for building pressure-treated wood foundations for homes are now available. The Small Homes Council/Building Research Council at the U. of Illinois has plans for crawl-space and basement foundations (see sketch) developed in cooperation with the American Wood Preservers Institute. An announcement says, "Advantages claimed include ease of construction, insulation and attachment of interior finish; elimination of the masonry trade from the job site; and ability to erect the foundation without regard to weather." Instruction sheets cost 50 cents each from the Small Homes Council/Building Research Council, U. of Illinois, 1 E. St. Mary's Rd., Champaign, Ill.

Pipes You Carve Yourself

[Continued from page 85]

liking, sand your untextured area perfectly smooth. Start with a fairly coarse grade of paper—120 is abou right—and work down to finer grits finishing off with steel wool. (O course none of this is necessary i your design is all rough-textured.) Whenever you switch to a finer paper wipe the pipe with a cloth to remov any chunks of the coarser grit tha might remain behind on the bowl.

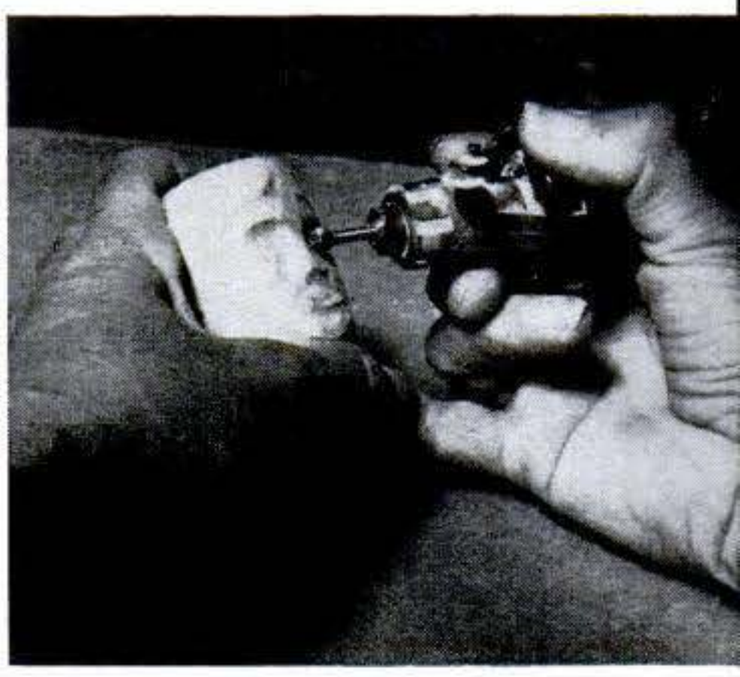
Staining? Fresh briar is fairly ligh in color, but it darkens with age You can speed this process with a water-base wood stain. This work well on a smooth finish, but don't tr it if your pipe is rough and rustic

Although there are pipe lacquer available, an easier and more natura finish is almost no finish at all:

Charge a 6" cloth buffing whee with tripoli and carefully go ove the entire surface of the pipe. Pres the wood firmly into the wheel a first, use lighter pressure to bring u a shine as you progress. Hold ont the pipe firmly, especially whe working around the opening of th bowl. As you buff you'll be amaze at the finish that comes up on th pipe . . . deep, rich, and warm.

Now change to a clean buffin wheel. Charge it with carnauba wa and repeat the buffing procedure. Th finish will turn even deeper. If yo can't find carnauba wax, a heav paste car wax—Classic car wax fo example—will do the job. Buffin complete? Clean the pipe inside an out with a cloth and it's ready t smoke.

Briar-block sources. Barclay-Re Pipe Shop, 7 Maiden Lane, New York N.Y. 10038, $5 with stem. Alber Constantine and Sons, 2050 East chester Rd., Bronx, N.Y. 10461, com plete kit, $14.95; blocks with stem $7.50. New Hampton General Store Box 371, Hampton, N.J. 08827, $ with stem.



Intermediate shaping is best done with ball-end bit of medium size. A solid gri on pipe and tool prevents misplaced cuts

Copyrighted material

Space Suits—from Pressurized Prison to Mini-Spacecraft

[Continued from page 64]

Outermost comes a white "overcoat" for protection against heat and micrometeoroids—grain-of-salt-sized particles hurtling down at thousands of miles an hour. Abrasion-resistant cloth reinforces knees, elbows, and shoulders.

In the backpack, cool oxygen circulating through the suit is reconditioned for reuse, and replenished as needed from a high-pressure tank. Cooling water flows through a "sublimator," a sort of metallic sponge in whose pores the water comes in actual contact with the vacuum outside and freezes. Evaporation of the ice into the vacuum chills the water behind it, and maintains any desired temperature in the suit.

For communication the astronaut wears twin mikes and earphones, in his "Snoopy Hat"—more elegantly, a space-suit communications cap—under his helmet. The radio antenna is on his backpack.

Fortunately for the astronaut, the weight of the suit and backpack on Earth (originally totaling 183 pounds) shrinks in the moon's weak gravity to one-sixth of that amount.

With succeeding moon landings, this Apollo outfit has gone through an evolution of its own.

How Apollo gear has changed. The biggest advance came when brief, hurried excursions afoot on the moon gave way to extended, carborne expeditions. Apollo 11 astronauts ventured forth for less than three hours; those of Apollo 12 and 14, for two sorties of about four hours apiece. Current three-day lunar stays, with a trio of excursions nearly twice as long as early ones, took more than revamping the Lunar Module to bring along augmented supplies.

The Apollo suit was remodeled. More oxygen, at higher pressure, went into the backpack. Increased supplies of cooling water and other "consumables" were added. That set the stage for the three long-duration expeditions that began with Apollo 15, continued with Apollo 16, and will end the Apollo program this December with Apollo 17.

A new waist joint, added to existing neck, shoulder, hand, and leg joints, did wonders for the 18-layer Apollo suit's flexibility. With its aid, Apollo 15 and 16 astronauts could sit down for a ride in their lunar roving vehicle, and could stoop to grasp lunar specimens retrievable before only with long-handled tongs or scoops. Space-suit designers were still far from their ideal of "nude-body mobility," but they were on their way.

From the first, the Apollo gear had a backup oxygen-supply and cooling system. If the regular one should quit, an emergency oxygen-purge system would release a blast of cool oxygen through the suit, allowing 30 minutes of grace for a fast retreat to the safety of the Lunar Module. It was, of course, outrageously wasteful of oxygen.

Apollo 14 introduced a modified plan—a "buddy" system enabling an astronaut in trouble on the moon to share his companion's cooling water. A connecting pair of flexible hoses, to make the hookup if need be, was carried on Apollo 14's two-wheeled utility cart and on the Apollo 15 and 16 lunar-roving vehicles. Thus relieved of its emergency-cooling function, the oxygen-purge system's breathing gas would last 1¼ hours, during return from a much greater distance.

Numerous other refinements included a container inside the helmet to refresh an astronaut with a sip of water or orange drink during his labors. Telling which was which of two helmeted moonwalkers baffled even NASA viewers until red arm and leg bands were added to the mission commander's space suit.

Apollo Command-Module Pilots, who do not land on the moon, need no lunar backpacks—but Worden and Mattingly, of Apollo 15 and 16, did use extravehicular suits. They made the world's first deep-space EVAs, between the moon and Earth, to retrieve films of the moon from panoramic and mapping cameras in a bay on the outside of the Service Module.

What's ahead? Definitely, future space suits are going places. If it taxed your imagination to think of the Apollo suit as a "spacecraft," consider space suits with self-propulsion gear attached, due to be tested under zero gravity inside our coming Skylab space station in 1973.

One trial hand-controlled model propels a suited astronaut with nitrogen jets, as pictured in an accompanying illustration. Another has foot controls and leaves hands free, for assembling structures or making repairs in space—likely future uses for these "mini-spacecraft."

Certainly our need for space suits will not end with Apollo. Skylab itself, for example, calls for EVA to recover, through an air lock, films of the sun made by its solar observatory. Missions of suited-up spacemen for jobs like tending Earth satellites will multiply with advent of the space shuttles planned for the late 1970s. It looks as if the story of the space suit's evolution has hardly more than begun. PS

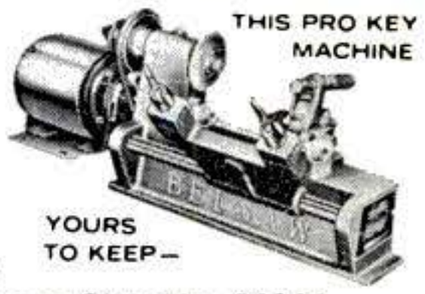
"Made $300 a month in spare time."—H. Rivas, Los Angeles, Calif.
"Cleared $110 last Saturday."—R. M. Davis, St. Louis, Mo.
"I hit $125 in one week sparetime!"—V. Tizio, Brooklyn, N.Y.

Who else WANTS to be a LOCKSMITH?

Train FAST at Home. It's EASY Making Up to $10 an Hour—even while learning!

If you enjoy fixing things, you're a "natural" to make hundreds of **EXTRA DOLLARS A YEAR** as a Locksmith. Need for service, sparked by rising crime, has never been so great and urgent. Easy, illustrated lessons complete with **ALL** practice equipment, personal assistance —**PLUS** professional tools and Key Machine given you free of extra cost—enable you to make **$5** to **$10** an hour... sparetime, or your own business. Hundreds we've trained are doing it.

Mail coupon for **FREE** facts—no salesman will call.
Accredited Member Nat'l Home Study Council. Approved for Veterans.



BELSAW INSTITUTE
113K **Field Bldg., Kansas City, Mo. 64111**

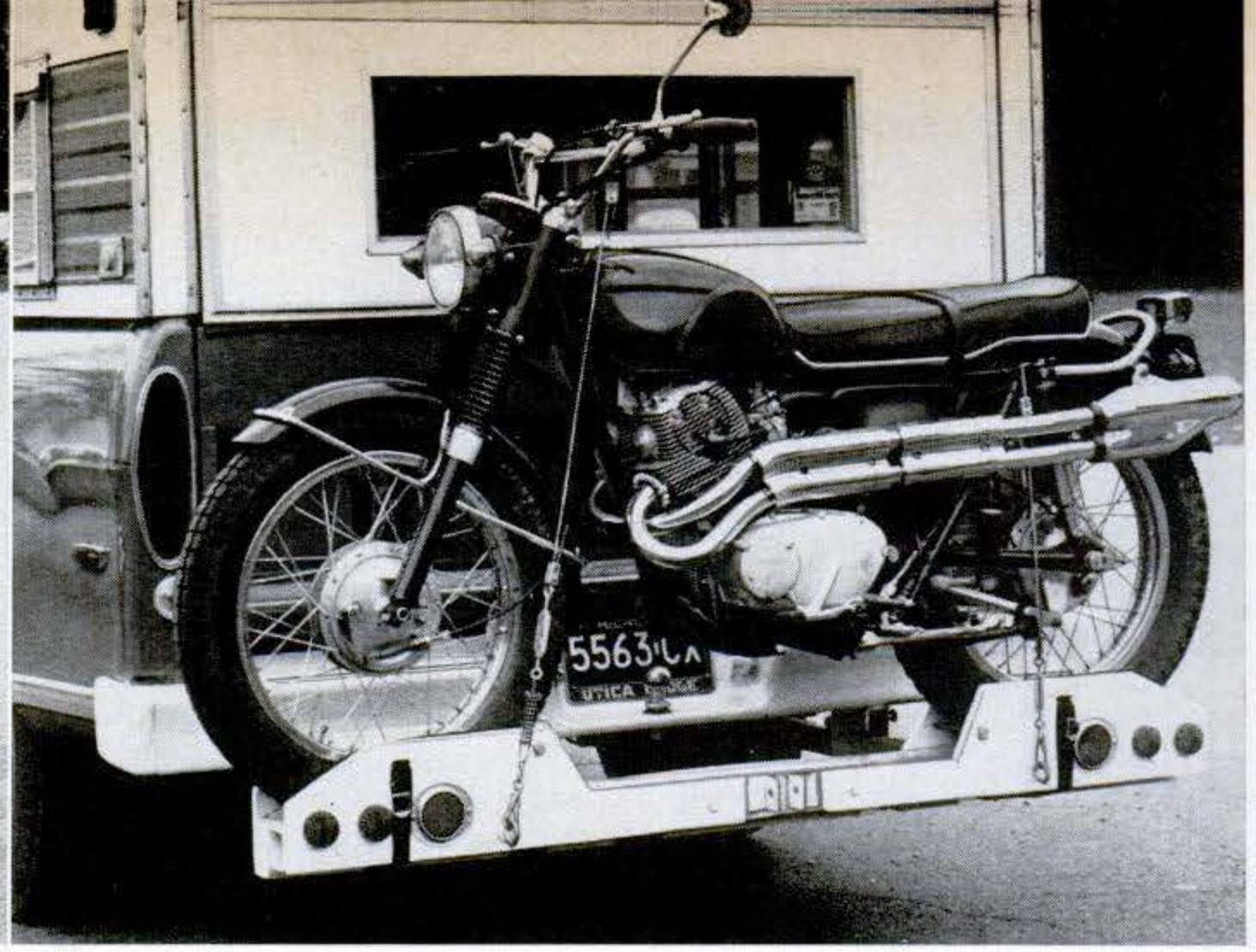
BELSAW INSTITUTE
113K Field Bldg., Kansas City, Mo. 64111
Name _____
Address _____
City _____ State _____ Zip _____
☐ Check here if eligible Veteran

These 3 BIG DRAFTING KITS GIVEN TO YOU!
. when you train at home with NASD for a
HIGH PAY JOB IN DRAFTING!

Take your pick of 1000s big salary jobs open to Draftsmen. U.S. Labor Dept. reports "42% more Draftsmen needed in next 10 years—not enough applicants to fill jobs available now." Easy home-study plan has helped 100s beginners toward $$$$$, security, prestige as Draftsmen—many with only grade school training. Others report good earnings drafting part time while still learning. Why not you?

RUSH COUPON FOR FREE KIT!
Mail coupon for **FREE "DRAFTING CAREER KIT," Sample Lesson,** Drafting **Aptitude Test** including new **5-Way Drafting Instrument** & 20-Page **Book,** "Your Future in Drafting" — ALL FREE. No salesman will call. **G.I. Bill approved.** Write today.

NORTH AMERICAN SCHOOL OF DRAFTING, Dept. 24187
4500 Campus Drive, Newport, California 92660
Rush **"DRAFTING CAREER KIT,"** including Book, Sample Lesson, Aptitude Test & Drafting Instrument—**ALL FREE!**
NAME _____ AGE _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____



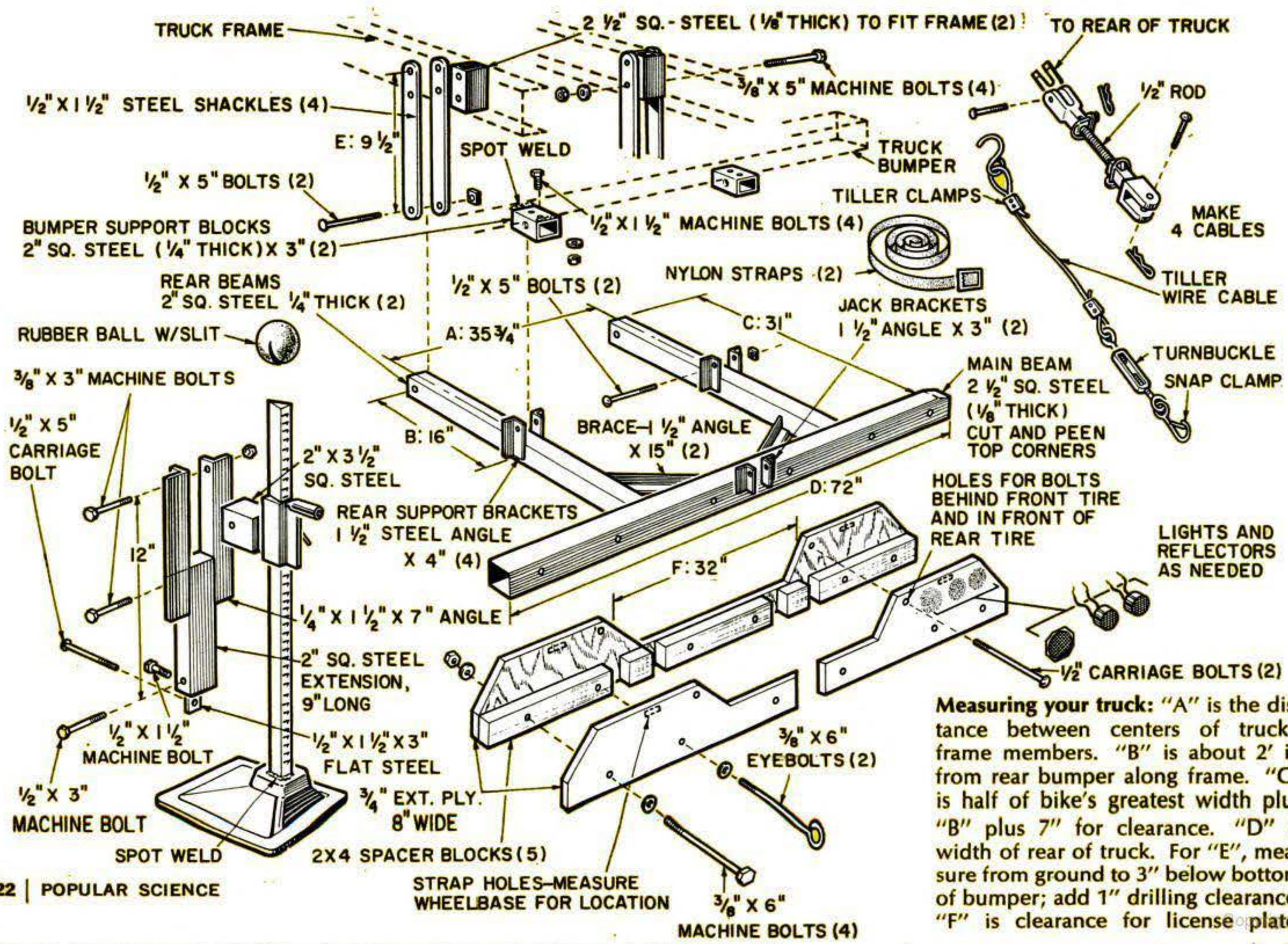
Modified bumper jack (left) makes loading your bike a one-man job. Turnbuckles on cables (right) adjust tie-downs for snug fit.

Jack Rack Lets You Truck Your Bike on Trips

By KENNETH H. ALDER

Own a pickup camper and a motorcycle? With this "jack rack" on the transom there's no more lifting and grunting to get your bike aboard. You just jack it up and tie it down.

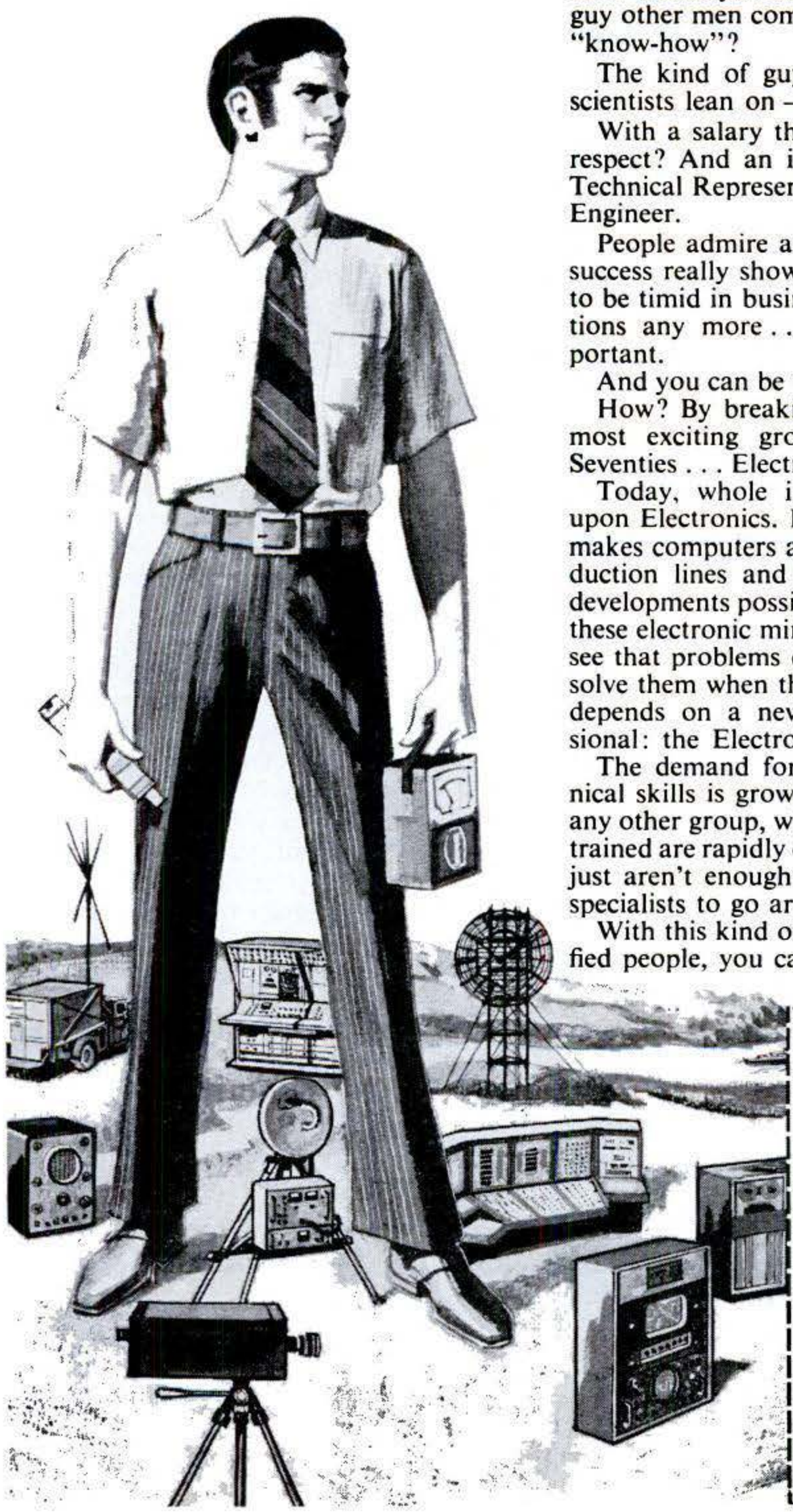
The rack shown below fits my '70 Dodge, but you can make one to fit just about any pickup. When measuring your vehicle, make sure you leave enough room for clearance between the motorcycle and the truck. After assembly, roll the bike on to measure for bolts (for wheel stops) and tie-down cables. Add lights and reflectors if needed. Got a big bike? Weigh it to be sure you won't be overgrossing the rear axle. Make sure it's on tight before you take off. PS



Measuring your truck: "A" is the distance between centers of truck's frame members. "B" is about 2' in from rear bumper along frame. "C" is half of bike's greatest width plus "B" plus 7" for clearance. "D" is width of rear of truck. For "E", measure from ground to 3" below bottom of bumper; add 1" drilling clearance. "F" is clearance for license plate.

You're a pretty important guy

...when you know Electronics. And now you can learn enough to break into this exciting field right at home in your spare time.



How would you like to be the kind of guy other men come to for advice and "know-how"?

The kind of guy businessmen and scientists lean on — and listen to?

With a salary that can bring a guy respect? And an impressive title like Technical Representative or Customer Engineer.

People admire a man like that. His success really shows. He doesn't have to be timid in business or social situations any more . . . because he's important.

And you can be that man!

How? By breaking into one of the most exciting growth fields of the Seventies . . . Electronics.

Today, whole industries are built upon Electronics. It's Electronics that makes computers and automated production lines and modern aerospace developments possible. And to keep all these electronic miracles running — to see that problems don't occur, and to solve them when they do — the world depends on a new breed of professional: the Electronics specialist.

The demand for people with technical skills is growing **twice as fast** as any other group, while jobs for the untrained are rapidly disappearing. There just aren't enough trained electronics specialists to go around.

With this kind of demand for qualified people, you can earn the kind of salary you've always dreamed about. Once you have some experience, you can make $12,000 a year or more . . . but beyond tangible rewards, is the satisfaction of working in interesting and vital new fields.

You might think you need college to break into this great field. But you don't. You don't even have to leave home to go to technical school.

The Cleveland Institute of Electronics can teach you all you need to know, at home, in your spare time.

CIE is the largest school in the country specializing exclusively in Electronics home training. The Institute's methods make learning Electronics easier, even for men who once had trouble studying.

It's all spelled out in two informative books that CIE will send you FREE. To get them, just mail the reply card. If the card is missing, use the coupon below or write Cleveland Institute of Electronics, 1776 E. 17th St., Cleveland, Ohio 44114.

It could be your first step toward becoming a mighty important guy in this fast changing world.

Approved Under New G. I. Bill

All CIE career courses are approved for training and **full tuition refund** under the G.I. Bill. If you served on active duty since January 31, 1955, or are in service now, check box in coupon for G.I. Bill information.

CIE Cleveland Institute of Electronics
1776 East 17th Street, Cleveland, Ohio 44114

Please send me 2 FREE books describing opportunities in Electronics and how to prepare for them.

Name _____ Age _____
(Please print)

Address _____

City _____ State _____ Zip _____

Veterans and Servicemen:

☐ Check here for G.I. Bill information.

Accredited Member National Home Study Council

PS-68

Copyrighted material

DO YOU REALLY WANT TO MAKE HIGH WAGES?

If you're truly serious, we can show you how.

Since 1955 we've trained thousands of men for high-paying careers as Heavy Diesel Equipment Operators and Mechanics. We can train you!

Men who know how to operate and maintain Dozers, Graders, Scrapers and Cranes have the skills that earn top wages—the same skills you can acquire.

National School of Heavy Equipment trains operators in the driver's seat at the controls working on actual construction projects. And diesel mechanics also learn by working on real machinery.

Accredited School . . . National is the nation's only strictly resident heavy equipment training school accredited by the National Association of Trade and Technical Schools, Washington, D.C. Veteran approved. Take the first step to a career of high wages. Write today for details on how you can qualify.

NATIONAL SCHOOL OF HEAVY EQUIPMENT, Dept. A-65 Phone 704-392-1359

P.O. Box 8529, Moores Chapel Road, Charlotte, N.C. 28208.

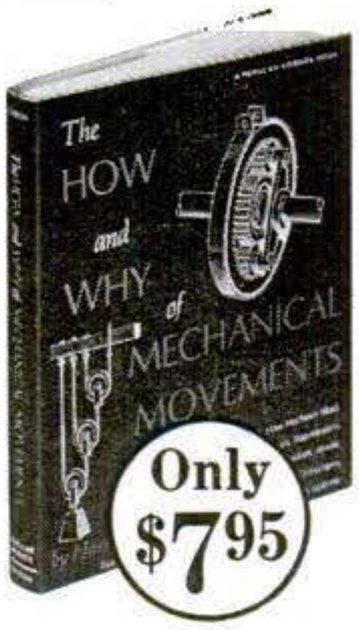
Please send me FREE illustrated school catalog and complete information. I understand there's no obligation.

NAME _____ AGE ____

ADDRESS _____ PHONE ____

CITY _____ STATE ____ ZIP CODE ____

"The practical section on the car—how the engine functions, the transmission, power steering and brakes—is worth the price all by itself." Publishers' Weekly



And that's just the beginning! THE HOW AND WHY OF MECHANICAL MOVEMENTS takes you on a fascinating tour of the whole world of machines and mechanics, *emphasizing the machines of today and tomorrow.* Yes, whether it's your car's transmission, a sabre saw, or turbo jet engines, this book tells (and shows with nearly 300 illustrations!) exactly how it works.

Send $7.95 for your copy of this brilliant picture-and-text adventure into the world of mechanics today! If you're not delighted with THE HOW AND WHY OF MECHANICAL MOVEMENTS, you may return it within 10 days for a full refund.

Popular Science/Outdoor Life Books

Dept. P772, P.O. Box 226, Manhasset, N.Y. 11030

Irradiated heat-shrinkable tape looks like ordinary electrical tape. Heat it, however, and it encapsulates with an airtight seal

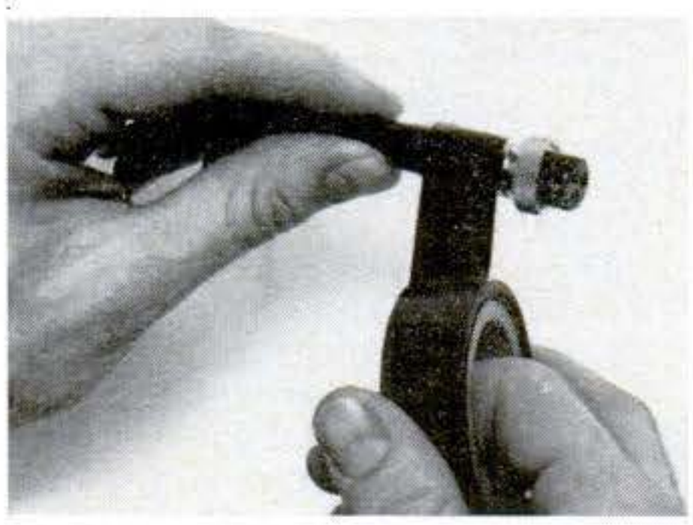
PERSONAL-USE REPORT

This Tape Shrinks as It Seals

What you see is not what you get. In fact, you get 30 percent less than what you start with, because Cole-Flex electrical tape shrinks—when you heat it—to form an airtight permanent seal around almost anything.

Called irradiated heat-shrinkable electrical tape, it's much like standard heat-shrinkable tubing—with two convenient exceptions: It can be added after a connection has been made, and it will cover irregular surfaces.

Use it on your outside antenna connectors, for example, and water can't get in to rust or play havoc with the connections. Got a leaky garden hose? A couple of wraps make the fix.



It's not as sticky as electrical tape, but it wraps in the same way. Each wrap must overlap to prevent air gaps and folds.

Shrinking process takes just seconds. Tar-like substance will fill all crevices. Propane torch can substitute for the heat gun.

Before heating, the Cole-Flex tape looks and feels like ordinary electrical tape, except that its back surface is not as sticky. As you wrap it, each successive layer must overlap the preceding one by 30 percent to prevent improper sealing.

When you heat it over 236 degrees F, several things begin to happen. The tape first begins to shrink longitudinally, tightening to two-thirds its normal size around an object. The trailing edge of the last wrap starts to lift, indicating that the shrinking process has begun and you must lightly push it back down into place. As the remaining wraps are heated, an inner liner begins to melt. This tar-like substance then flows evenly throughout the tape wrappings and over the crevices of the object the tape covers. Once it cools, you're left with an airtight bond that completely encapsulates the object.

Where will you get 236 degrees F? Not from a soldering-iron tip, nor a converted hair dryer. They will begin to shrink the tape, but they simply are not hot enough to complete the operation.

The proper tool, obviously, is a heat gun like the one shown. But you can make do with a propane torch—a more versatile tool to have around the home. Even with the heat gun, though, you'll find, as I did, that shrink tape is not as easy to work with as shrink tubing. It took a few trials before I got to know when there was enough heat. But after getting the hang of it, I found this new tape a handy addition to my shop supplies.

It comes in ¾", 1½", and 3" widths; prices start at $7.80 for 54 feet. Cole-Flex, 91 Cabot St., West Babylon, N.Y. 11704.—*W. J. Hawkins*

Copyrighted material

Those New CB Radios

[Continued from page 95]

resultant frequency out of the FCC park. Also, since each crystal has its own harmonics, spurious radiations must be carefully kept in check. Fortunately for us, this has all been done, according to the set manufacturers; and, fortunately for them, the FCC seems to agree.

Almost all units use the synthesizing principle. It's one of the reasons for their compactness and ease of control. The Courier Classic II, for example, is small and neat enough to sit on a kitchen counter where you-know-who can detour your drive home from work for a loaf of bread. Radio Shack's Mini 23 adds a few tricks to become one of the smallest around. It takes up just a portion of the usual glove compartment, but has all 23-channel capability.

Portability means versatility. Sure, you can buy a base station, a mobile, or one that will work as both (most of these do), but now the new trick is to remove one of these units from your car, say, and strap it to your back. Sets like Lafayette's HB 23A simply slide into a battery pack, complete with whip antenna. This is a great idea if you're a CB'er who likes to hunt, go camping, or just walk a lot. That's what a walkie-talkie is for? Right, but this approach makes the system versatile. Ever try using a walkie-talkie as a base station?

On the other hand, if you're a hunter, perhaps a walkie-talkie is all you need. Hunter-to-hunter communication can be a real asset in tracking prey, and the old superregenerative walkie-talkies will work fine for distances to about a half-mile. There's no difference in these new models and the first ones that hit the market—except that now you can buy them a lot cheaper. Need an inexpensive communications system that you won't mind losing in the wild? These cost under four bucks apiece. PS

Superregenerative walkie-talkies like this one still have some good applications and cost no more than $15 a pair.

Eye Guards Your Home

[Continued from page 96]

The cell's sensitive front surface must be looking through the tube—the tube's designed to serve as a directional baffle.

Solder one of the photocell's leads to the copper tube, then cement the tube into a 5/8" hole cut in one end of a 2¼"-by-1⅜"-by-1½" (or similar size) aluminum minibox.

Mount a terminal strip in the box to provide soldering points to join the photocell to the connecting cable. Use ordinary shielded hi-fi or audio cable to join the photocell to the main chassis. The cable can be any length under 25 feet.

Using the eye. To operate the circuit, simply point the photocell sensor at the intended light source, and adjust the sensitivity control, R4, for the *minimum* sensitivity setting that will keep K pulled in. This setting will insure that the relay will trip open when an object passes in front of the sensor.

Remember, extremely bright ambient light (for example, if the sensor is pointed toward a bright sky) will blind the cell, making it insensitive to alternating light. When you install the device, try to position the photocell so it does not look at sunlight or intense AC-powered lamps. The photocell will not be injured by such exposure, but the circuit will refuse to respond to low-intensity light sources afterward.

Once you're satisfied with the cell's placement, test it a few times by walking through the restricted area. You should hear the relay click into place each time.

Use the terminal strip to connect the photocell's electronics with whatever you wish to control. Be sure to use a grommet in the access hole for the terminal strip to prevent a possible short circuit. Remember, in some cases a false alarm can be worse than the real thing. PS

PARTS LIST

C1—1.0-mfd capacitor
C2, C5—0.47-mfd capacitors
C3—0.1-mfd capacitor
C4—0.01-mfd capacitor
C6—50-mfd @ 10v, electrolytic capacitor
C7, C8—500 mfd @ 10v, electrolytic capacitor
R1—2,000-ohm, ½w, carbon resistor
R2, R3—47,000-ohm, ½w, carbon resistor
R5—100,000-ohm, ½w, carbon resistor
R6—68-ohm, ½w, carbon resistor
R4—2,500-ohm, linear taper, carbon potentiometer
PC—cadmium sulphide photocell (Radio Shack 276-116 or equiv.)
B—rectifier bridge (HEP 176 or equiv.)
IC—integrated circuit (RCA CA 3035)
Q—Darlington amplifier transistor (HEP S9100)
T—6.3v @ 0.3a filament transformer (Stancor P-6465)
K—miniature relay (Calectro D1-965)
LM—120v AC neon indicator lamp
S—SPST toggle switch
Misc: Barrier terminal strip; perforated board and terminals; miniboxes; line cord

ALUMINUM JELLY™ is camp.

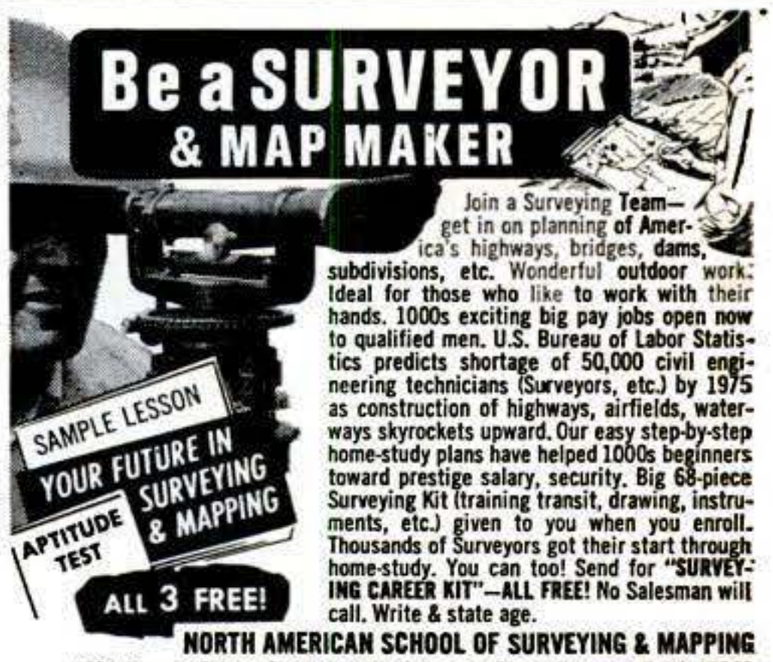
The camper's delight. It removes oxidation from aluminum tent poles, cookware, chairs and trailers. Everything aluminum. Brush it on, wash it off. Oxidation's gone and aluminum is clean and bright.

Available at fix-it counters everywhere

DURO PLASTIC

World's Finest Fix-It Products
Woodhill Chemical Sales Corp., Cleveland, Ohio 44128

Be a SURVEYOR & MAP MAKER



Join a Surveying Team—get in on planning of America's highways, bridges, dams, subdivisions, etc. Wonderful outdoor work. Ideal for those who like to work with their hands. 1000s exciting big pay jobs open now to qualified men. U.S. Bureau of Labor Statistics predicts shortage of 50,000 civil engineering technicians (Surveyors, etc.) by 1975 as construction of highways, airfields, waterways skyrockets upward. Our easy step-by-step home-study plans have helped 1000s beginners toward prestige salary, security. Big 68-piece Surveying Kit (training transit, drawing, instruments, etc.) given to you when you enroll. Thousands of Surveyors got their start through home-study. You can too! Send for "SURVEYING CAREER KIT"—ALL FREE! No Salesman will call. Write & state age.

NORTH AMERICAN SCHOOL OF SURVEYING & MAPPING
4500 Campus Drive • Dept. 24187 University Plaza, Newport, Calif. 92660

LEARN MEAT CUTTING

Train quickly in 8 short weeks at Toledo for a bright future with security in vital meat business. Big pay, full-time jobs — HAVE A PROFITABLE MARKET OF YOUR OWN! Time payment plan available. Diploma given. Job help. Thousands of successful graduates. Our 49th YEAR! Send now for big new illustrated FREE catalog. No obligation. G.I. Approved. #0197T

NATIONAL SCHOOL OF MEAT CUTTING
Dept. 51-K, Toledo, Ohio 43604

TECHNICAL EXCELLENCE IN ELECTRONICS.

On our small, friendly campus the emphasis is on Living as well as Learning. Extra-curricular social activities, student clubs, a student operated radio station, student government, new dormitory and a full sports program help provide a world of your own in which to prepare for tomorrow. Associate Degree in Engineering Electronics. B.S. obtainable. G.I. approved.

VALPARAISO TECHNICAL INSTITUTE
Dept. S, Yellowstone Trail, Valparaiso, Indiana 46383

UPHOLSTERING AND DECORATING FOR PROFIT! Men & Women All Ages!

At home, we show you how, incl. tools, kits to make and sell. Accredited NHSC. Approved Veteran Training. No salesmen.

Creative UPHOLSTERY & DECORATING SCHOOL, Dept. 5111-072, Little Falls, N.J. 07424

Copyrighted material

Can we know our past lives?

Does personality survive death? Do experiences of past lives cling to our consciousness—as the scent of a flower lingers on? There are mistakes you could avoid—things you could do differently—if you could be certain. Have you felt strangely unlike yourself—more like someone else—with different inclinations and personality? Do new places and faces seem familiar?

FREE BOOK

Do not let hypocrisy and prejudice deny you the truth about yourself. Reincarnation is just one of the many subjects dealt with in the Rosicrucian teachings. You can live more fully, masterfully, if you use your Cosmic powers and faculties. Write the Rosicrucians (not a religion) for a free copy of the book, "The Mastery of Life." SCRIBE: C.T.B.

The ROSICRUCIANS
(AMORC)
San Jose, California 95114, U.S.A.

Scribe C.T.B.
The ROSICRUCIANS (AMORC)
San Jose, California 95114, U.S.A.

Please send me a complimentary copy of the book "THE MASTERY OF LIFE."

Name_____

Address_____

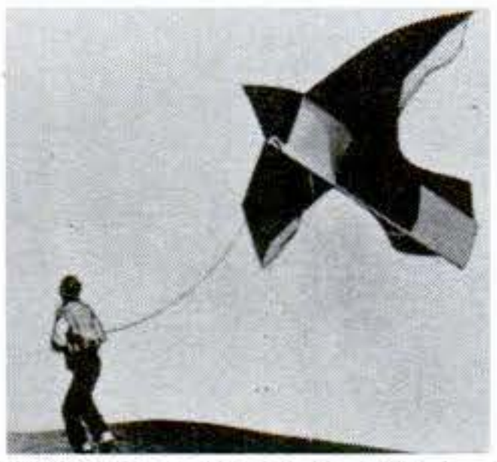
City_____

State_____ Zip_____

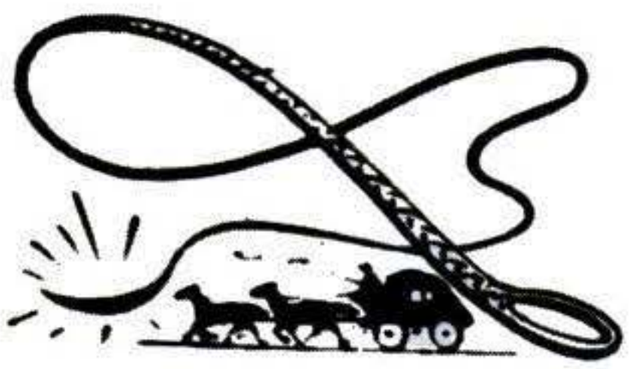
Shoppers' Showcase

SOLID-STATE STEREO AMPLIFIER. A 100-watt amplifier featuring a built-in circuit for derived 4-dimensional stereo sound. Two additional rear speakers necessary for LA-950 in derived 4-channel stereo mode. On/off switches for Main Power, Loudness, Stereo/Mono, Tape Monitor & High Filter. Stock #99-02792W. $99.95. Lafayette Radio Electronics, Dept. PS, 111 Jericho Turnpike, Syosset, N.Y. 11791.

EMMA C. BERRY, a scale replica of the ship restored & berthed in Mystic Seaport, Connecticut. Model is 4'L x 3½'H, constructs much like a real vessel using ribs, planking & stepped masts. Kit contains die-cut wood parts, tapered spars, rigging, metal fittings, sails, plans & instructions. $34.95 + $1 shipping. Catalog of ships & cannons 25¢. Preston's, 96-M, Main St. Wharf, Greenport, N.Y. 11944.



GIGANTIC SPACE KITE. This 5½ foot kite stopped the World Series! Made of tear-proof acetate, comes with winding reel & 500 feet of cord. For Adults Only—may lift a small child into the air! Only $9 + $1 pstg. Children's kite, 4 feet, $5.50 + 50¢ pstg. Gordon Leasing Co., Dept. PS-7, 828 Bernard Pl., Ho-Ho-Kus, N.J. 07423.



GENUINE LEATHER BULL WHIP. Loud noise! Cracks like a rifle. Experts knock people off their feet, put out cigarettes, knock ashes off cigars, etc. Coil it or crack it! Used by cowboys, trainers, ranchers. Woven 4-ply genuine leather, 6 feet long. Only $1.98. World Co., Dept. PS-7, 1 Park Ave., New York, N.Y. 10016.

WRIST ROCKET®

AMERICA'S HARDEST HITTING SLING

Range 225 yd.—232 fps.
Matched replacement rubbers and LEATHER pouch assembly $1.00
At dealers or order direct.

WRIST ROCKET® Mfg.
P.O. BOX 471-A
Columbus, Nebraska 68601

$3.00 Post. Pd. in U.S.A. No C.O.D.'s
Orders outside U.S.A. add $1.50 for postage and handling.

STOP dripping faucets forever

Pat. Apl. For

90% of faucet leaks are due to bad seats. The brass pits and corrodes. Obtaining the correct seats with washers and installing them is very difficult. There are over 100 different sizes and thread combinations available. Install *VULCAN UNIVERSAL FOREVER PREASSEMBLED STAINLESS STEEL SEATS WITH DELRIN WASHERS.* Also ends the frustration of hot water shutdown caused by expanding rubber washer.

KIT INCLUDES: 8 Seats with washers (Do the whole house and garden), Recessing tool, Anaerobic Adhesive, EASY Pictorial Instructions. $4.95 + 50¢ shipping & handling.

VULCAN MFG. CO.
Box 33, Dept. PS7, Grand Valley, Colo. 81635

Compressed air from car lighter

Speedy **auto-flator**

• Now have air wherever you go! Even remote areas. Emergency air for tires, air jacks, space-saver spare. Inflate mattresses, boats, rafts, pools. Plugs into 12-volt system in auto, trailer, truck, boat. Space-age size . . . only 6½ inches long. Amazing pressure up to 60 lbs.! Only $29.95 (plus $1.00 shipping) with air hose and inflator attachments. Send check or money order on 10-day, money-back, guarantee.

W. R. BROWN CORPORATION
2775 N. Normandy Ave., Chicago, Ill. 60635

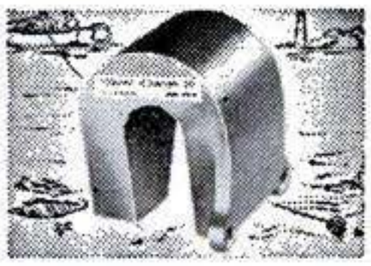
Copyrighted material

LIVE IN THE WORLD OF TOMORROW . . . TODAY! NEW PRODUCTS, NEW MATERIALS, NEW IDEAS!

UNUSUAL ECOLOGICAL & PHYSICAL SCIENCE BUYS

UNIQUE HARD-TO-FIND BARGAINS FOR FUN, STUDY OR PROFIT

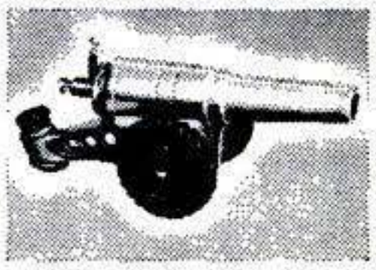
"FISH" WITH A MAGNET



Go treasure hunting on the bottom! Fascinating fun & sometimes profitable! Tie a line to our 5½-lb. Magnet—drop it overboard in bay, river, lake or ocean. Troll it along bottom — your "treasure" haul can be outboard motors, anchors, other metal valuables. 5½-lb. Magnet is war surplus—Alnico V type—Gov't cost $50. Lifts over 150 lbs. on land—greater weights under water.

Stock No. 70,571N ..... **$14.00 Ppd.**
Stock No. 60,215N ..... **1½ lbs.** ..... **$ 5.75 Ppd.**
Stock No. 70,570N ..... **3½ lbs.** ..... **$ 8.75 Ppd.**
Stock No. 85,152N ..... **15¾ lbs.** ..... **$33.95 FOB**

BIG BOOM & FLASH CANNON



Perfectly safe giant noisemaker for sports, games, the 4th and just plain fun produces brilliant flash and loud bang. Completely harmless—no gun powder, matches or recoil. Easily operated. Beautiful reproduction of regular Army 60 MM cannon in hefty cast iron. "Ammo" is pulverized Bangsite combined with water in cannon producing harmless gas. Cannot be ignited by hottest flame or heaviest concussion. Incl. ammo for 200 shots, instr. Wt. 2¼ lbs.

Stock No. 70,898N ..... **$6.95 Ppd.**
25" "Big Bertha" Cannon (5½ lbs.)
Stock No. 71,654N ..... **$16.50 Ppd.**

SELF-PRIMING 350 G.P.H. PUMP

Lifts water 20 ft., pushes it 50 ft. Drain flooded basement, aquarium, boat; fill tanks, transfer most liquids (not gasoline). Brass connections fit garden hose, ½" pipe. Instant self-primer pump (3½x4½x7¼") non corrosive. Just 1 moving part. Stainless steel wear plates. System incls. handle, pump, hi-torque encl. 115v AC motor w/ thermal overload protection, two suction & discharge hoses, 6-ft. heavy duty grounded cord, brass strainer, instrs. and 10-year guarantee.

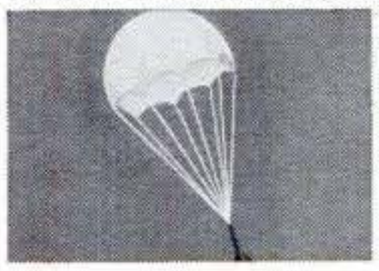
Stock No. 71,440N ..... **$39.95 Ppd.**

WAR SURPLUS ELECTRIC GENERATOR

Brand new Signal Corps Model. Up to 90 volts by turning crank. Use in high impedence relays. Charge ground & bring up night crawlers for bait or study. 2 Alnico Magnets alone now worth more than original $15 gov't cost.

No. 50,225N ..... **(2lbs.)** ..... **$8.50 Ppd.**

THREE FT. DIA. SURPLUS PARACHUTES!



THE REAL THING! . . . kids and model rocketeers love them! Tie toy soldiers to the shroud lines, toss 'chute in the air and watch it gently float to earth. In model rocketry, it's an ideal deployment 'chute for recoverable nose cones. These 3-ft. diameter all-nylon parachutes with 8 shroud lines originally cost the gov't, about $5 each. We offer 4 of them, each packed in a small cloth bag, at a fraction of the cost. Great buy, great fun!

Stock No. P-41,680N ..... **$3.00 Ppd.**

NEW $99.50 HELIUM-NEON LASER!

Completely assembled, instant-starting w/3X power output of comparable models. Steady, ripple-free light of moderate (safe) power. Excellent collimation. Simple and safe to use. 4½ lb. unit reaches 75% power in 2 secs.; 100%, typically 0.5 milliwatt (0.3 mW minimum) in 3 mins. Beam divergence 2 milliradians—2 cms at 40 ft.

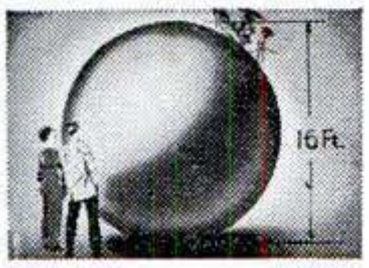
Stock No. 79,004N ..... **$99.50 Ppd.**
Single mode Lazer
Stock No. 79,008N ..... **$129.50 Ppd.**

BUILD A "PRO" WEATHER STATION

Meteorology kit can give you the know-how to check your predictions against official forecasts! Has remote reading anemometer w/windvane. Indoor indicator board flashes neon, shows wind speed, direction. Safety power cord holds current to less than 1 ma. Also: sensitive air-tank barometer w/2-ft. indicator column; sling psychrometer to measure rel. humidity; rain gauge that measures to 1/100th inch; 100 ft. lead-in wire; cloud chart; forecasting manual.

Stock No. 71,022N ..... **$13.95 Ppd.**

GIANT WEATHER BALLOON



"Balls of fun" for kids, traffic stoppers for stores, terrific for amateur meteorologist. Create a neighborhood sensation. Great backyard fun. Exciting beach attraction. Amateur meteorologists use to measure cloud heights, wind speed and temp. Made of heavy duty neoprene. Inflate with vacuum cleaner or auto air hose; or locally available helium for high rise.

Stock No. 60,568N .... **(8 Ft. diameter)** ... **$2.00 Ppd.**
Stock No. 60,632N ... **(16 Ft. diameter)** ... **$7.00 Ppd.**

VISIBLE V-8 ENGINE

Hours of fun! Get thrill of building your own easily assembled engine from over 350 parts. Then push starter and watch it run. Crankshaft revolves, pistons move, valves open and close in sequence with spark plugs. Does everything but burn oil. 1/4 scale, molded in 4 colors. Same motor used in many auto-mechanic courses. Excellent, easy-to-understand "tech manual."

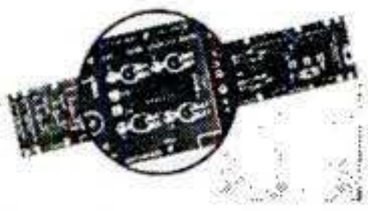
Stock No. 70,448N ..... **$13.50 Ppd.**

POWER HORN BLASTS A MILE

Frighten prowlers, muggers, vicious dogs with 118 decibels. Just press and this Freon powered pocket-sized horn can be heard a mile away to signal for help or fun. Great for boating (it floats), hiking, camping, hunting, seashore, rooting for your team. Can be heard over traffic and constr. noises to sound fire drill, lunch break or emergency. Weighs only 3 oz. but contains up to 100 mile-piercing blasts. A real bargain.

Stock No. 41,423N ..... **$3.25 Ppd.**
Giant 9-ounce Air Horn.
Stock No. 71,630N ..... **$8.20 Ppd.**

DIGITAL COMPUTER LOGIC LAB



Fascinating new way to learn computer types, binary systems, truth tables, logic. Make ring counter, shift register and binary counters. Play with reaction timer, electronic coin flipper. Experiment with memory, counting & arithmetic circuits. 4 assembled module circuits (clock, solid-state nand gates, flip-flop, display), 20 patch cords for 100's of circuits—23 computer experiments. No electronic know-how needed! 74 pg. illustr. manual explains all. Req. 6v batt. (not incl.).

Stock No. 71,403N ..... **$39.75 Ppd.**

MINIATURE WATER PUMP

Wonderful for experiments, miniature waterfalls, fountains, etc. Tiny (2⅝" x 1¾") electric motor and pump ideal for hobbyists, labs, schools. Pumps continuous flow of water at rate of one pint per minute at a 12" head. With two "D" batteries in series, will pump up to 24" high. Runs 48 hours on battery. Works in 2 directions. Self-priming.

Stock No. 50,345N ..... **$2.25 Ppd.**

AMERICAN MADE OPAQUE PROJECTOR

Projects illustrations up to 3" x 3½"—enlarges them to 35" x 30" if screen is 6½ ft. from projector, larger pictures if screen is farther away. No film or negatives needed. Primarily intended for children. Projects charts, diagrams, color or black-and-white in darkened room. 115 v A.C. . . . 6 ft. cord and plug included. Size 12" x 8" x 4½" wide. Weight 1 lb. 2 ozs. Plastic case.

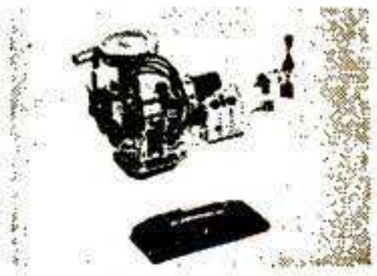
Stock No. 70,199N ..... **$8.75 Ppd.**

ASTRONOMICAL TELESCOPE KITS

Grind your own mirror for powerful telescopes. Kit contains fine annealed pyrex mirror blank, tool, abrasives, diagonal mirror, and eyepiece lenses. Instruments you build range in value from $75.00 to hundreds of dollars.

Stock No. 70,003N
4¼" diam., ¾" thick ..... **$10.75 Ppd.**
Stock No. 70,004N
6" diam., 1" thick ..... **$16.95 Ppd.**
Stock No. 70,005N 8" diam., 1⅜" thick .. **$24.50 Ppd.**
Stock No. 70,006N 10" diam., 1¾" thick
30 lbs. ..... **$44.50 FOB**
Stock No. 70,007N 12½" diam., 2⅛" thick
46 lbs. ..... **$72.50 FOB**

AMAZING NEW Wankel KIT!



Thrill to the fun of building your own see-through motorized model of revolutionary pistonless type engine . . . only engine experts think economically modifiable to meet new pollution standards. Replaces piston, cylinder, crank assemblies with rotating discs (sections removed for firing chambers). Smaller than conventional; fewer parts, greater reliability, same speed w/less horsepower. Feat: flashing plugs, rubber fan belt, stick-shift on-off switch. Req. 2—1.5V batt. (not incl.).

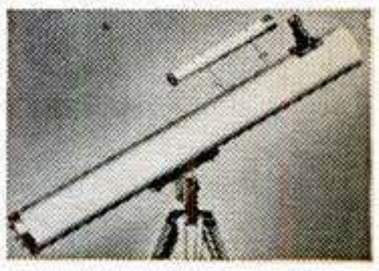
No. 71,424N ..... **(4½" 5" x 9"** ..... **$6.75 Ppd.**
519 Page Wankel Engine Book
Stock No. 9,439N ..... **$15.25 Ppd.**

1st QUALITY OPAQUE UNDER $200

Terrific Buy! Top Quality! Projects brilliant, sharp 4½ ft. sq. image from 8' using up to 5"x5" color, b&w illustrations. Retains all original colors, proportions. Enlarges drawings, coins, maps, etc. Revolutionary peanut-size quartz Halogen lamp (50hr. life), 200 mm anastigmatic lens (f3.5,8"F.L.), unique internal reflecting system give maximum brightness, entire field focus. Can be used upside down. Turbo-cooled. 5½ ft. cord.

Stock No. 71,272N .... **(Wt. 11¼ lbs)** .... **$98.75 Ppd.**

3" ASTRONOMICAL TELESCOPE



See moon shots, orbits—stars, phases of Venus, planets close up. 60 to 180 power. Aluminized and overcoated 3" diameter f/10 primary mirror, ventilated cell. Equatorial mount with locks on both axes. Equipped with 60x eyepiece and mounted Barlow lens. 3x finder telescope, hardwood tripod. Included FREE: "STAR CHART"; "HOW TO USE YOUR TELESCOPE."

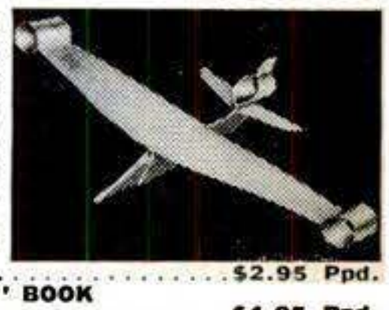
Stock No. 85,050N ..... **$32.95 Ppd.**
DELUXE 3" APOLLO REFLECTOR
STOCK NO. 80,162N ..... **$59.50 Ppd.**
STOCK NO. 85,105N 4¼" REFLECTOR .... **$94.50 FOB**
STOCK NO. 85,086N 6" REFLECTOR ..... **$239.50 FOB**

HELIUM BALLOONS MAKE A "BALL"

Anytime there's a balloon the air is festive. Especially when the "air" is helium, which makes a balloon perky and adventurous. Now here's 20 times the fun—20 various colored balloons of 4, 5, 6" diameter when inflated. With them, a pressurized (300 lbs/sq. in.) can containing 20 liters of helium to inflate all 20. For adults or kids' parties, give-aways bazaars or just demonstrating "lighter than air". Helium is a safe non-toxic inert gas.

Stock No. 71,289N ..... **$3.00 Ppd.**

GREAT INT'L. PAPER PLANE BOOK



Official fly-them-yourself book of paper airplanes from *SCIENTIFIC AMERICAN'S* "1st International Competition". Includes plans of all winning entries, time-aloft records, photos, technical data, commentaries. Has 20 unusual designs on perforated pages for easy tear-out. You won't believe how some of them fly! Amusing, entertaining. 128 pages, 9" x 11¾".

Stock No. 9391N ..... **$2.95 Ppd.**
"STICK-PAPER AIRPLANES" BOOK
Stock No. 9427N ..... **$4.95 Ppd.**

MAIL COUPON FOR GIANT FREE CATALOG!

148 PAGES • MORE THAN 4000 UNUSUAL BARGAINS!

Completely new Catalog. Packed with huge selection of telescopes, microscope, binoculars, magnets, magnifiers, prisms, photo components, ecology and Unique Lighting items, parts, kits, accessories—many hard-to-get surplus bargains. 100's of charts, illustrations. For hobbyists, experimenters, schools, industry.

EDMUND SCIENTIFIC CO.
300 Edscorp Building, Barrington, N.J. 08007
Please rush Free Giant Catalog "N"

Name.....

Address.....

City..... State..... Zip.....

EDMUND SCIENTIFIC CO.

ORDER BY STOCK NUMBER • SEND CHECK OR MONEY ORDER • MONEY-BACK GUARANTEE

300 EDSCORP BLDG.
BARRINGTON, NEW JERSEY 08007

Copyrighted material

Shoppers' Showcase

GOVT. SURPLUS
and other bargains
SAVE to 90%

Fantastic catalog. Fully illustrated. 1000's of bargains in hydraulics, electrical, marine, aircraft, automotive items and more! Send 35c postage & hdlg. In a hurry? Send $1 for airmail. **Must incl. zip.**

AIRBORNE SALES CO. Dept. PSC
8501 Steller Dr., Box 2727, Culver City, Ca. 90230
Satisfying world-wide customers since 1945

HEAVY DUTY WELDER

with special $7.00 gift offer to Popular Science readers
10-DAY FREE TRIAL
Lifetime Guarantee
Brand New 1972 Model 18.95 POST PAID

FITS ORDINARY 110V OUTLET • 6 WELDING HEATS
Weld, braze, solder or cut most anything made of metal. No experience necessary. Follow simple instructions to make repairs on cars, trailers, farm and lawn equipment, bicycles, appliances, etc. Make campers, boats, furniture, hundreds of valuable items. NOTHING ELSE TO BUY! Comes complete with full face shield, pack of welding and brazing rods, heavy duty power cables, special electric torch attachment, ground clamp, flux, easy-to-follow illustrated instructions, rod holder, etc. Uses standard 1/8" rods to weld iron, steel, brass, bronze, aluminum, other metals. New improved HEAVY DUTY circuit gives more welding power. Gives 4 times the heat needed to melt toughest iron. Plugs into ordinary 110V outlet. 6 WELDING HEATS plus continuously variable carbon-arc heat regulation control lets you weld anything from "tough" jobs to light-weight metals with ease. This important feature saves you money and time. Makes it possible for even beginners to start welding professionally the very first day. Pays for itself quickly. An excellent gift for any occasion. IT'S AUTOMATIC: Current is turned ON when arc is struck, OFF when rod is lifted from work. Eliminates need for troublesome foot switch. Speeds up work. Lifetime guarantee.

FREE! Mention that you saw this ad in Popular Science and receive a $7.00 gift pack assortment of "touch weld" welding rods. Automatic arc striker. Weld with "push button" ease.

10 day MONEY BACK GUARANTEE. You must be satisfied or return for refund. Send only $2.00 and pay postman $16.95 plus postage when delivered or send $18.95 cash, check or money order for immediate postpaid shipment.
Wel-Dex Mfg. Co., Dept. W-202, Box 10776, Houston, Tex. 77018

Enjoy Independence

With A Sparetime BUSINESS OF YOUR OWN

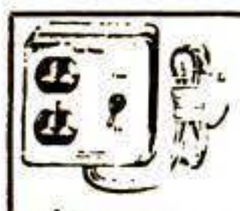
Earn sparetime cash while you develop a money-making business of your own. Investment is small. No overhead, no stock to carry, no selling involved. Automatic Foley Saw Filer, easy to operate, files combination saws, hand, band, circular saws. No experience needed.

Earn $3 to $6 An Hour In Sparetime

Get started now, watch your business grow! Thousands earning cash this easy way—many build complete sharpening service with year round profits.

FREE BOOKLET SHOWS HOW
Fact filled booklet tells how to start sparetime business; how to get new business. Get "Money Making Facts" and details on Easy Payment Plan. No salesman will call.

FOLEY MANUFACTURING CO.
Dept. 719-2 Foley Bldg., Minneapolis, Minn. 55418



Patent Pending

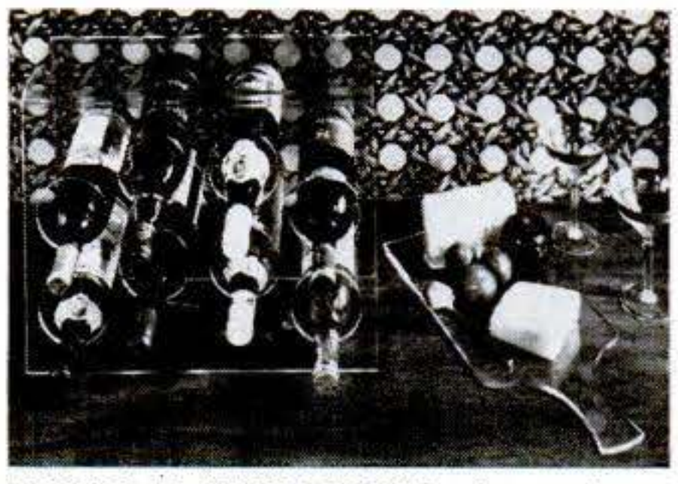
TOOL POWER™
110 VOLTS D.C.

3,000 Watts 0-50 amps from your car's alternator. Operates heavy duty drills, saws, and lights, battery charging. Arc welding. Does not operate A.C. motors on refrigerators and air conditioners. Installed in 10 minutes. Guaranteed 5 years. $25.00 Postpaid. Dealerships available.

A.C. Generators
60 Cycles, 110 Volts,

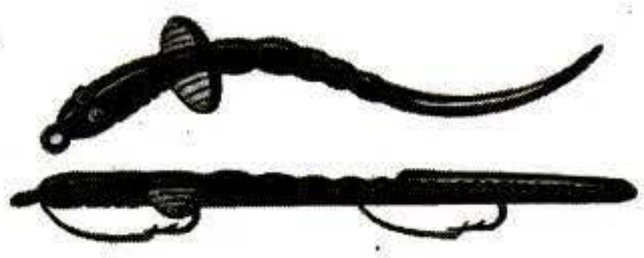
Fanbelt driven. Runs power tools, T.V.'s, refrigerators, radios, A.C. motors to ½ H.P. Cannot operate air conditioners. 1,500-watt. $60.00 plus $5.00 postage. 3,000-watt $99.50 plus $6.00 postage. P.O. Box 7066, 2821 Mays St.
VIRDEN PERMA-BILT CO. PS Amarillo, Texas 79109

MAGIC PRINT TRANSFER kit permanently transfers "slick" magazine illustrations or words to clothing. Custom design towels & clothes with pictures of public figures, animals, etc. Best results achieved from high-quality, clay-based paper. Illustrations transfer to almost any fabric, won't wash out. Do not dry clean. Kit #71,597, $3.95. Edmund Scientific, 380 Edscorp Bldg., Barrington, N.J. 08007.



PLEXIGLAS WINE RACK & cheese board you can make yourself. Just follow instructions in "Do It Yourself with Plexiglas Acrylic Sheet" booklet with dozens of projects for the home. You will find this booklet wherever Plexiglas is sold (hardware, wallpaper, paint, building supply & glass stores)—or send 25¢ with name & address to: Rohm & Haas Co., Dept. PS, P. O. Box 9730, Philadelphia, Pa. 19140.

DOGGIE DOOLEY septic tank. Shovel waste into unit & non-poisonous enzymes & bacteria action liquefies waste for ground absorption. Complete with foot operated lid, shovel, enzymes (6 mo. supply), fireplug enzyme holder & moisture retaining inner-liner. $9.95 + $1 pstg. Extra enzymes (12 mo. supply) $3.95 + 60¢ pstg. J. W. Holst, Dept. PS-7, 1005 E. Bay St., East Tawas, Mich. 48730.



UNBEATABLE 6" FRESH WATER EELS! Perfect for top or bottom fishing. Soft, supple vinyl plastic with 2 gold weedless-hooks. Will not catch or hang up on rocks, weeds or stumps. A replica of a natural eel with contrasting colored "wings." Satisfaction guaranteed. Three popular colors & patterns only $1.29 ppd. Sports Liquidators, Box 733-6FW, Sun Valley, Ca. 91352.

BUILD YOUR OWN
Cabover Campers • Covers
16' & 20' Travel Trailers
• PLANS •
PATTERNS • KITS
★ FREE CATALOG ★
GLEN L Recreational Vehicles

9152-S7 Rosecrans, Bellflower, Calif 90706

"LISTEN IN" TO POLICE-FIRE RADIO CALLS IN YOUR CAR!

Works with **Any Car**—Portable or **Home Radio!** Just **Plugs** in—No wiring—3 minute hookup! Switch instantly from regular to **All Police-Fire-Emergency-Commercial-Taxicab-State-City-Gov't** 2 way Radio calls in **Your Area. Dual—Hi-Low Bands—Over a Million** Radio Cars/Stations. **Use** Everywhere-anytime-always works!

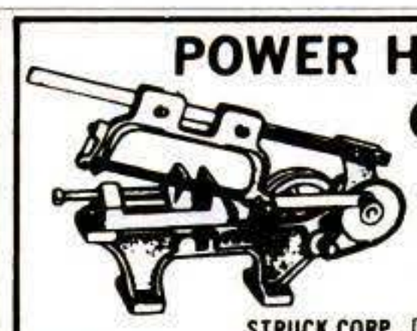
SEND ONLY $2.00 (cash, Ck., M.O.) and pay postman $7.99 plus COD pstg. or send $9.99 for ppd. Del. in USA. **Complete,** ready to use with instructions. One Year service Warranty—**10 Day Money Back Trial** (if retnd). **Amazing Offer** good only by mail—
WESTERN RADIO Dept. BPS-7 KEARNEY, NEBR. 66847

ALWAYS INCLUDE YOUR ZIP CODE WHEN ANSWERING ADS

HEADQUARTERS FOR EVERY TYPE & SIZE AT REAL DOWN-TO-EARTH MONEY SAVING PRICES!

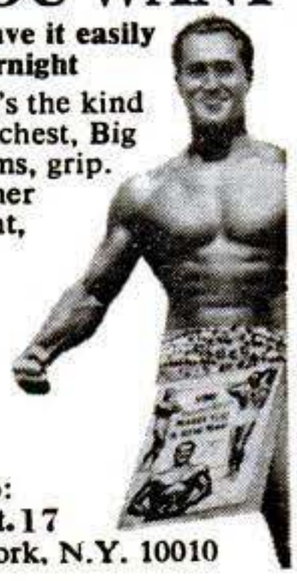
ALL FAMOUS BRANDS! **TIRES!** AUTO TRUCK SPORT CAR FARM TRAILER
TREMENDOUS SAVINGS!
LET US PROVE IT TO YOU! ...WRITE US TODAY...
Send for your FREE catalog!
RELIABLE TIRE DIST. 1109 Chestnut St. Camden, N. J. 08103

POWER HACKSAW KIT
ONLY $24.95



Also 51 other money-saving projects to be built in the home workshop. Lathes, drill presses, vises, etc. Send 50¢ for 28 pg. Catalog.
STRUCK CORP., Dept. PS-72, Cedarburg, Wis. 53012

JUST PICK THE KIND OF BODY YOU WANT
—and you can have it easily almost overnight



Dear Charles Atlas—Here's the kind of body I want: ☐ Broad chest, Big shoulders. ☐ Powerful arms, grip. ☐ Powerful legs. ☐ Slimmer waist, hips. ☐ More weight, solid. ☐ More energy. Send me a free copy of your famous 32-page book showing how **DYNAMIC-TENSION** can make me a new man.

Send name and address to:
CHARLES ATLAS, Dept. 17
115 East 23rd St., New York, N.Y. 10010

Enjoy An Exciting, Romantic IMPRESSIVE *LOOK* ANYTIME!
QUICK-CHANGE to suit your mood time:
ALL THREE $6. MODOCRYLIC

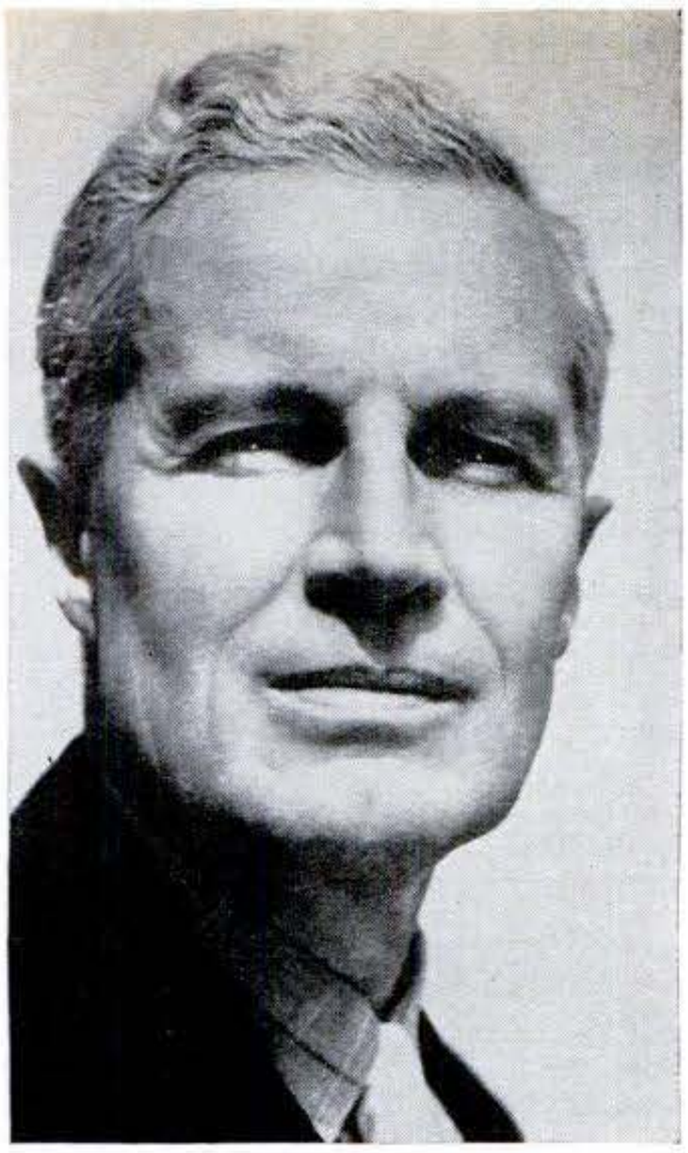
Send for your Mustache, Sideburns and Van Dyke at once! Simply check the color you want or send a sample of your hair and leave the matching to our expert. MAIL COUPON NOW!

Adheres securely . . . off and on in seconds . . . can be worn as is or trimmed to just the style you want

To Order give hair color ☐ Blonde; ☐ Black; ☐ Light Brown; ☐ Medium Brown; ☐ Dark Brown; ☐ Grey; ☐ Silver; ☐ Auburn or send hair sample. ☐ Mustache $2; ☐ Deluxe Mustache $5; ☐ Sideburns $3; ☐ Deluxe Sideburns $5; ☐ Van Dyke $3; ☐ Deluxe Van Dyke $5; ☐ All Three $6; ☐ All Three Deluxe $10 (I save $5)

Masculiner Co., Dept. 888
160 Amherst St., East Orange, N.J. 07019
SOLD ON MONEY BACK GUARANTEE

Copyrighted material



I'd like to give this to my fellow men...

while I am still able to help!

I was young once, as you may be — today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest $15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

VICTOR B. MASON
1512 Jarvis Ave., Suite M-3-BH
CHICAGO, ILLINOIS 60626

Copyrighted material

Shoppers' Showcase

BENSEN — THE PERSONAL COPTER

WORLD'S MOST POPULAR HOMEBUILT AIRCRAFT

Take this easy first step now: Get our colorful INFO PACKET (for Copter $5, Glider $3) with Design Information/Flight Characteristics; 3-View Drawings; in-flight photo; Construction Hints; 6-page "Bensen Bulletin" with numerous pictures plus descriptions of Plans, Kits, Engines, and flyers' comments . . . and a Certificate for $5 (or $3) toward the purchase of Construction Plans with Flying Instructions. Read how others enjoy their personal Gyros. Pilot ages range from teens to over 60, novices and pros. Even if you never fly, the Packet is fascinating! Send for it now.

SEND $5 OR $3

BENSEN AIRCRAFT CORP., Dept. PS-72
RDU Airport, P.O. Box 2746, Raleigh, N. C. 27602

NAME _____

ADDRESS _____

THE HEAVIEST HUMAN ON RECORD WEIGHED 1,069 LBS. AND WAS BURIED IN A PIANO CASE!

The Highest Alimony Ever Paid Was $11,550,000. A War That Lasted 38 Min. A Woman Who Bore 69 Children. The Largest Insect . . . a "Goliath Beetle." The World's Most Expensive Perfume At $370 An Ounce.

The biggest! The smallest! The richest! The highest! The oldest! The longest! The fastest! The greatest! **The Guinness Book Of World Records** contains over 3,000 records of science, nature, the achievements of man, the world of sports, the arts, entertainment and little known fantastic phenomena. Packed with unbelievable facts and over 350 photos.

Settle any argument! Amaze your friends! You will not be able to put it down. This 600 page hard covered volume is a must for any library. Over 5,000,000 copies sold worldwide. Only **$5.95** (moneyback guarantee).

BOOK OF WORLD RECORDS, DEPT-G16
1966 BROADWAY, N.Y., N.Y. 10023

Please rush me ___**Guinness Book Of World Records** at $5.95 each (plus 60¢ post. & hand). Enclosed is my check or money order for_____ . . .If not completely satisfied, I will return the book within 15 days for a full refund.

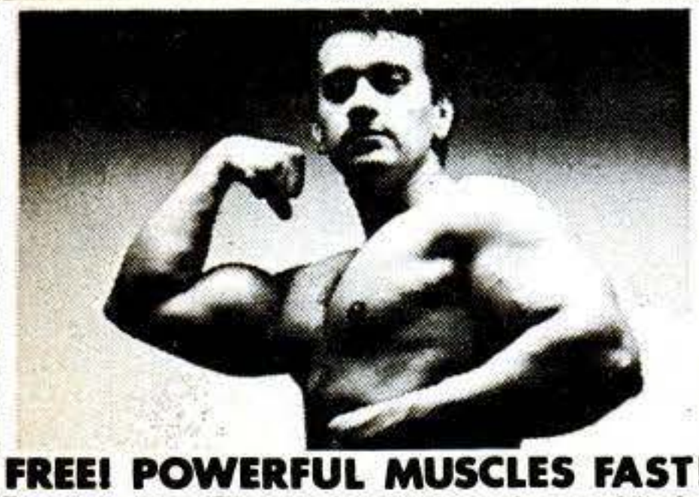
Mr.
Mrs.
Miss _____

Address _____

City_____ State_____ Zip_____

Make check/M.O. payable to Book Of World Records

© Broadway Bookfinders, 1972

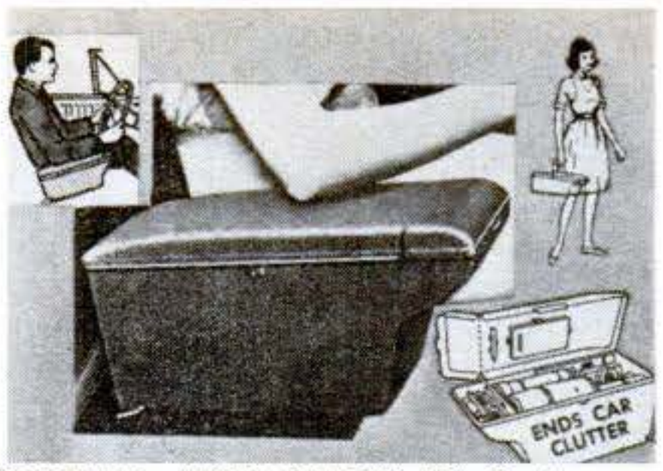


FREE! POWERFUL MUSCLES FAST!

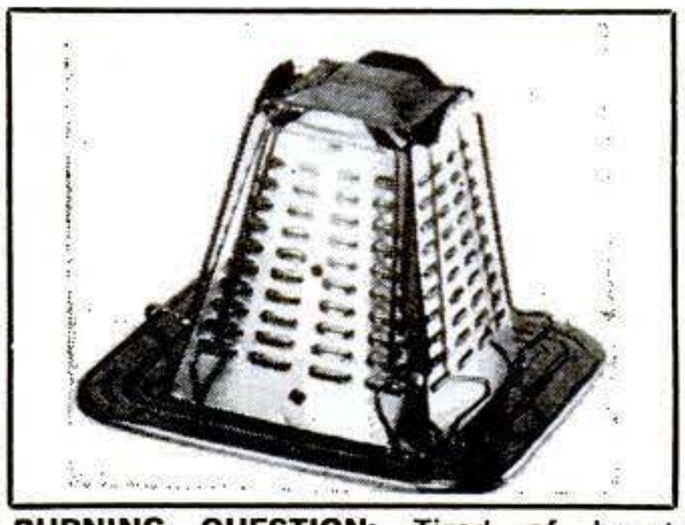
Fantastic New Discoveries in the science of body-building. Our method will add inches of powerful muscles to arms, chest, shoulders & legs. Learn secrets on trimming the waist with ultra-modern methods—fast! Results Guaranteed! Send for free brochure. Universal Bodybuilding Box 485-A Dearborn, Michigan 48121

LEATHER LEVI BELT. Feels great, looks greater. Famous Levi leather belt is the "IN" thing. Rugged 1¾" oil-tanned harness leather with 2¾" heavy alloy buckle in handsome copper finish. Aptly inscribed with "LEVI STRAUSS & CO. ★ S.F. CAL." Only $7.95 + $1 hdlg. Also free FUN WEAR catalog loaded with items from LEVI'S wealth of exciting ideas. Outdoor World, Dept. PS-7E. Estes Park, Colo. 80517.

ADJUST-A-POWER hose nozzle. A completely new garden hose nozzle has all new design & features a solid jet stream with adjustable sprays, pin-point stream & a complete shut-off. Lifetime LEAK-PROOF guarantee. Only $2.49. Write: William R. Teson Co., Dept. PS, P.O. Box 1393, Torrance, Calif. 90505.



HOLD-ALL AUTO CADDY. Eliminates car clutter & has ample room for all car paraphernalia. Caddy has over 500 cu. inches of storage space, 3 compartments & fits snugly in front or rear seat of any car. Separate sections for coins & eyeglasses. Includes Pad & Pencil. Rugged Black Morocco finish, waterproof & scuffproof. 15 x 16 x 7". $6.98 ppd. J. W. Holst, Dept. PS-7, 1005 E. Bay St., East Tawas, Mich. 48730.



BURNING QUESTION: Tired of burnt toast? You can toast 4 slices at once; watch it as it turns golden brown. Get exact shade you like. Uses no electricity. Use over gas stove burner or fireplace. Great for campers. Warm up to this nifty gift, $1.98 ppd. Best Values, Dept. 591, 160 Amherst St., E. Orange, N. J. 07019.

New Table Top Invention Puts You In...

PROFITABLE RUBBER STAMP BUSINESS

Home Operators now make $16.50 AN HOUR in Business once monopolized by a few big companies

Special rubber stamps bring high prices—cost only pennies to make on new, low-cost table top machine. Take 27 cents worth of material, make perfect stamps, the kind businesses and offices now buy by the dozen at $2.75 each. Make up to $16.50 an hour. Start in spare time in your own home. Run machine on kitchen table using ordinary electrical outlet. Make any kind of stamp. We'll send you free information without obligation about this established, highly profitable business. ***We'll even help finance your start.*** For free information send name and address today on a postcard to:

Rubber Stamp Div., 1512 Jarvis, Dept. R-3-BH, Chicago, Ill. 60626

PUMP DRAINS pools, cellars, laundry tubs IRRIGATES — CIRCULATES — SPRAYS

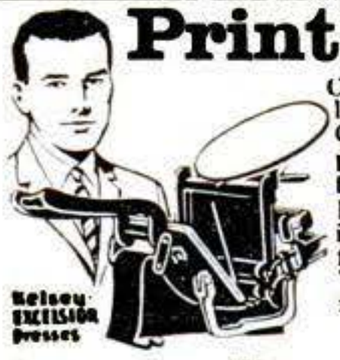
Heavy duty ball bearing pump. All metal, rust-proof Type XB. Stainless shaft. Use ¼ HP or larger. 1 HP 1,200 GPH 60' high or 3,000 GPH 25' well. 5,200 GPH max. 1¼" in; 1" out. Belt or direct drive. **$13.95**

Type P won't rust or clog. Bronze bearing. To 2,400 GPH. 1" in; ¾" out. **$9.95**

P'pd cash with order. **Money back Guarantee.**

LABAWCO, Box 34, Belle Mead, N.J. 08502

Print For Profit



Cards, Stationery, Advertising, labels, tickets, announcements, QSL cards, greeting, sympathy, prayer cards, etc. Save money. **Print for others, good profit.** Have home print shop. Pays for itself in a short time. Sold direct from factory. Easy rules sent. We supply everything. Send 25c for catalog. **KELSEY PRESSES, 72-U Meriden, Conn. 06450**

MAIL THIS COUPON TODAY

Kelsey Presses Dept. 72-U Meriden, Conn. 06450

I enclose 25c send big catalog and free samples.

Name _____

Address _____

City _____ State _____ Zip _____

SILVO (BRAND NAME) TOOL CATALOG

Thousands of exciting tool values!

Thousands of Exciting Tool Values! Stanley, Millers Falls, Skil, Thor, Wen, Disston, Wiss Wellsaw, Dremel, Speedy Sprayers, Plumb, Huot, Kennedy, Channellock, Porter-Cable, Rockwell, Helios, Vise-Grip, Crescent, Ridgid and many other Nationally Advertised brands of Tools & Supplies. We ship Coast to Coast at prices Hard to Beat. Send 50¢ for our big 146 page tool catalog today.

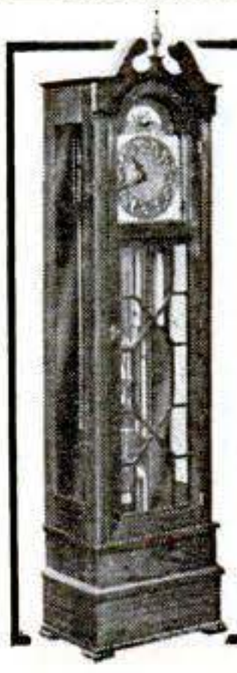
SILVO HARDWARE CO.

107 Walnut St., PSD7 Phila., Pa. 19106.

I-N-V-E-N-T-O-R-S WE NEED INVENTIONS

Sell your invention for cash—need money for patent?—Are technical problems holding you back? Universal Inventions has helped inventors all over the world—Just like yourself—why not you? Inventions provide the magic spring-board to sudden riches. REMEMBER, we either sell your invention or pay you a cash bonus. Write for details.

UNIVERSAL INVENTIONS, Dept. 12, Marion, Ohio



BUILD YOUR OWN

GRANDFATHER CLOCK

Save over 50% by building your own grandfather clock. Stately, straight-sided **"AMERICAN CLASSIC"** with beveled plate glass sides. Narrow waist designs; **"SPIRIT OF '76"** with finely sculptured crown and brass-tipped pillars; or easy to build, always popular **"SPIRIT OF THE CENTURY."** Our kits are Red-i-Kut, semi-assembled, hand-crafted of solid ¾" kiln-dried mahogany, cherry or walnut. Tubular bell or Westminster rod chimes. Moving moon dials painted by our own artists, and our own original Goddess Diana or Lady Florentine pendulums. Gorgeous solid bronze dials with raised numerals and corners. Send $2.50 for all three plans, plus description of kits and movements, as folks have for more than fifty years.

KUEMPEL CHIME CLOCK WORKS & STUDIO

Route 3, Box 240 S-7 • Excelsior, Minnesota 55331

Copyrighted material

4 WAYS TO GET RICH! AND HAVE FUN

Join America's exciting new hobby—Treasure Finding. These sensitive instruments work through dirt, sand, wood, water, and even rock with no loss of power. Quality engineered lightweight and fully transistorized. Operates many hours on an inexpensive 9 volt battery. Order Now . . . all models in stock.

THE MUSTANG "330"

Detects a penny to 5 inches. Detects sharply with "Sound off" loud speaker. Very powerful, comes complete, ready to go.

ONLY $39.95*

FREE BONUS

This $4.00 value is yours free when you order a Jetco Treasure Finder.

Made in USA
Full 5 year Warranty

**FIND LOST COINS, RINGS, GOLD, SILVER, AND RELICS.
WHERE: SCHOOL YARDS, PARKS, BEACHES, OLD HOUSES, VACANT LOTS VIRTUALLY ANYWHERE. DETECT ALL METALS.**

THE SEARCHMASTER "550"

Detects a penny to 6 inches. Has sensitive Vernier tuning for detecting fringe items.

ONLY $69.95*

THE TREASURE HAWK "990"

Detects a penny to 8 inches and silver dollar to 12 inches. Has view meter loud speaker, sensitivity switch, battery tester, dual search loops. Power to spare.

ONLY $129.95*

THE HUNTMASTER "770"

Detects a penny to 7 inches. Has view meter, loud speaker, dual search loops, extra sensitivity.

ONLY $99.95*

**TO: JETCO ELECTRONIC INDUSTRIES, INC.
P. O. Box 26669 Dept. PS
EL PASO, TEXAS 79926**

I enclose $_____ + $2.00 shipping cost for $_____ total—
Rush me a

☐ MUSTANG ☐ SEARCHMASTER
☐ HUNTMASTER ☐ TREASURE HAWK
☐ Send me a free detailed catalog only

Name _____

Address _____

City _____ State _____ Zip _____

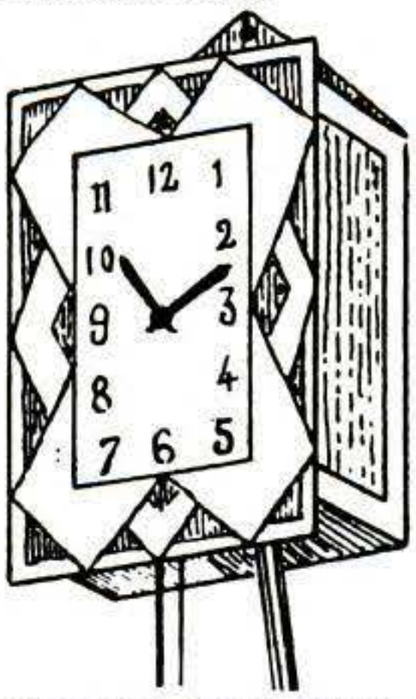
*Texas residents add 5% sales tax

Copyrighted material

CLOCKS YOU BUILD and LEARN MASTERFUL ENGINEERING

Build a clock and you know how it works. Two kits, at left a verge and foliot escapement with modern plastic engineering applied to the world's oldest movement. And the result will both look & run well in your living room.

Below a clock built of cardboard. The techniques of building a rigid frame and gears of cardboard are fascinating. Clear diagrams show construction so you won't really mind that the instructions are printed in French.



CALDWELL INDUSTRIES
LULING, TEXAS

Books continue education. The books in the coupon begin where these kits leave off.

One book is called The CRAFTSMANSHIP CATALOG. It has clocks & machine tools, steam engines & locomotives. It costs $2.00 but it makes good reading and your satisfaction is guaranteed.

Plastic Clock Kit	☐	$5.50
Cardboard Clock Kit	☐	3.95
The CRAFTSMANSHIP CATALOG	☐	2.00
Teach Yourself Horology	☐	4.00
Practical Watch Adjusting	☐	6.00
Practical Watch Repairing	☐	8.00
Practical Clock Repairing	☐	7.50
Simple Cardboard Models	☐	4.00
Model Stationary Steam Engines	☐	4.50
International Paper Airplane Book	☐	3.50

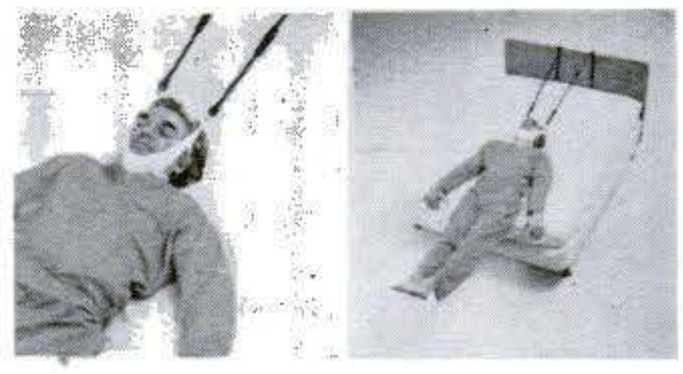
CALDWELL INDUSTRIES
BOX 170, LULING, TEXAS 78648

NAME

ADDRESS

Shoppers' Showcase

CATCH MORE FISH in salt or fresh water. A few drops on live, artificial or preserved bait attract big fish. At a depth of 6 feet, Ketchem's scent spreads to a radius of 60 feet. Natural ingredients are actually beneficial. Approved by State Conservation Departments. Satisfaction guaranteed. 1 bottle $2; 3 bottles $5. Ketchem Unlimited, P. O. Box 6603-5, Columbus, Ohio 43209. Dealer inquiries invited.



STRETCHACISER is made of sturdy double-stitched canvas, chrome-steel rings, flexible rubber cords & a patented fastening device. It can be attached & used anywhere. Complete instructions included. Check with your physician before beginning any program of exercises. Send check or M.O. for $29.95. 15-day money back trial. Write: Stretchaciser, Inc., Dept. PS, P.O. Box 200, E. Paterson, N.J. 07407.

SIX PACK COOLER is molded from expanded polystyrene beads with six individually sealed chambers. Keeps beverages cold up to 12 hours without use of cooling agents. Compact designed for easy handling & storage. Lightweight. $2.49 ppd. (N.Y. res. add sales tax.) Write: Ever-Kool Co., Dept. HB56, P.O. Box 725, Amityville, N.Y. 11701.

ANTIQUE CRADLE PHONE. Base is only 4¾" by 5¾"; 5" high. Rebuilt for modern use in 10 decorator colors: Pink-blue-green-yellow-white-beige-ivory-gold-black or red. Fitted with standard cord & plug for instant use. $23.95 (shipping charge $1.50). With buzzer & decorated dial $34.95. Free catalog. Grand Com, Inc., Dept. PS-7, 1152 Sixth Ave., New York, N.Y. 10036.

CASH IN ON THE FAST GROWING FIELD OF SECURITY

For Job Security Or Your Own Business

LEARN TO BE A **BURGLAR ALARM TECHNICIAN**

A specialized course — theory and practical training with complete alarm & test equip. provided — yours to keep. **One of the biggest problems facing the nation today is crime. One burglary every 15 seconds. The demand for security is here. See what this field has to offer you. Write for free brochure.**

STATE SCHOOL of Security Devices
1 North Rosalind Ave., Orlando, Fla. 32801

CHANGE OIL INSTANTLY
Without Getting Under Car

Fast!
Convenient!
No Mess!
Save Money!

New Electric Oil Changer With Vacuum Action Works From Oil Level Guage.

For Autos, Truck, Boats, Tractors, bulldozers, snow mobiles. Powerful rotary vacuum pump with 13,500 rpm D.C. motor is generated by current from any cigarette lighter receptacle or 12V vehicle battery. Housing unit is of sturdy tough polypropiene, compact (3" x 5" x 6"), weighs about 1 lb. Buy quality oil in bulk, start saving money. Comes complete with depth sounding wire, flexible suction tubes, vinyl exhaust pipe and stopper, simple instructions. Only **$14.95** plus $1.25 pp.

Send check or M.O. Full 1 year guarantee.

J.W. HOLST, INC., Dept. PSC-7
1005 E. Bay St., East Tawas, Mich. 48730

NEW 1972 ARC
WELDER
19.95 5 WELDING HEATS

Plugs in any ordinary 110 volt outlet. Buy direct from the factory and save $$ Complete — nothing else to buy. Includes *heavy duty cables *electrode holders *ground clamp *extra welding rods *full face mask. Heavy duty — 5 heats for welding, soldering, cutting and heating. Easy to operate; step-by-step instructions included. Ideal for the home handyman or craftsman — pays for itself repairing cars, trailers, lawn equipment, boats, etc.

10-DAY MONEY BACK GUARANTEE. Send only $2 and pay postman $17.95 plus postage when delivered, or send $19.95 for prompt postpaid shipment. Return within 10 days for refund if not completely satisfied. Orders filled promptly — check or money order. **LIFETIME GUARANTEE.**

MINI 5 ARC WELDER, Dept. C, 2635 Main St., Houston, Texas 77002

HOW TO GET RICH — AT HOME!

There is no other business like mail order. Start on a shoestring in your spare time and make a fortune fast. It strikes like a bolt of lightning! Millions read your ad and suddenly you are swamped with cash orders from all over the country. MORE MONEY in 60 days than you could earn in a lifetime! Write for free book and complete details.

Mail Order Associates, Inc., Dept. 209, Montvale, N.J. 07645

MINI — 3 WHEELER PLANS!

Exciting NEW 3-wheel plans reveal step-by-step details!

ALSO MINI BIKE AND KART PLANS

RUSH $2 for plans! (INDICATE TYPE) TO:

FREE! DISCOUNT COUPON ON PARTS WITH PLANS!

PLANS, P.O. Box 793, Dept. PS-7 Fremont, Nebr. 68025

LOCKSMITHING & Key Making

PRACTICAL UP-TO-DATE COURSE — ONLY $7.95

Teaches you how to pick locks, de-code, make master keys, repair, install, service, etc. New self-instruction lessons for every handyman, homeowner, carpenter, mechanic, service station operator, fix-it shop, hardware dealer, gunsmith. 53 easy, illustrated lessons. Full price only $7.95 postpaid. Satisfaction or refund guaranteed. Mail order today!

Nelson-Hall Co., Dept. GY-1
325 W. Jackson Blvd., Chicago 60606

2000 NOVELTIES Free Catalog

FREE! World famous catalog of hard-to-get Novelties, Tricks, Jokes, Pranks, Hobbies, Sports, Science, Electronics, Peace & Love Gear, Mod, Psychedelic, Cloth Patches, Shirt Transfers, Lights, Jewelry, Bargains, Gadgets, Books, Games, Photo & Optical, Tools, etc. No letter necessary. Send ad, name, address. Johnson Smith Co., Dept. C-117, Mt. Clemens, Mich. 48043.

Copyrighted material

TAKE OFF...STRAIGHT UP in a Scorpion Too

Have you heard about sport flying? Did you know that you can participate in your own personal helicopter

The Scorpion Too is RotorWay's answer to backyard flight.

Remember, the Scorpion is a true vertical take-off helicopter, it takes off straight up.

Using a 140 h.p. engine, it cruises at 75 m.p.h. and can carry over 400 lbs. The most exciting news about the twin-seat Scorpion is its low cost, but then it's about time a helicopter became a recreational vehicle.

The twin-seat Scorpion is designed to be built and flown for the same price as its successful single-seat predecessor.

Find out about the complete Rotorway story . . . a truly exciting adventure in vertical flight.

Send $5 for the full color introductory package and special offer.

RotorWay

ROTORWAY, INC.
Dept. B2/14805 S. Interstate 10
Tempe, Arizona 85281

Name _____
Address _____
City _____ State _____ Zip _____

GARNET

DUR-TEK ABRASIVE CORPORATION COATED ABRASIVES VULCAN

BELTS SHEETS DISCS

GARNET ABRASIVE IS KIND TO WOOD

Portable Cloth Belts	Sheets	Discs
_____3" x 18"	_____9" x 11"	_____5" x Universal*
_____3" x 21"	_____3–2/3" x 9"	_____6" x Universal*
_____3" x 24"	_____4–1/2" x 5–1/2"	_____7" x Universal*

9 Belts to a box (3 fine; 3 med.; 3 coarse) Resin Bonded . . . . . $ 4.60 per box
4,455 Sq. In. to a box (equal sheets: fine, med, coarse) . . . . . $ 3.80 per box
75 Discs to a box (25 fine, 25 med, 25 coarse) . . . . . $ 4.10 per box
* Universal Fits 1/4" to 3/4". Va. & N. Y. residents add Sales Tax

Check items wanted - enclose payment - we pay postage
Write for prices on other items or sizes. **Highest Quality Only.**

Ship to:

Name: _____
Street: _____
City: _____
State: _____ Zip: _____

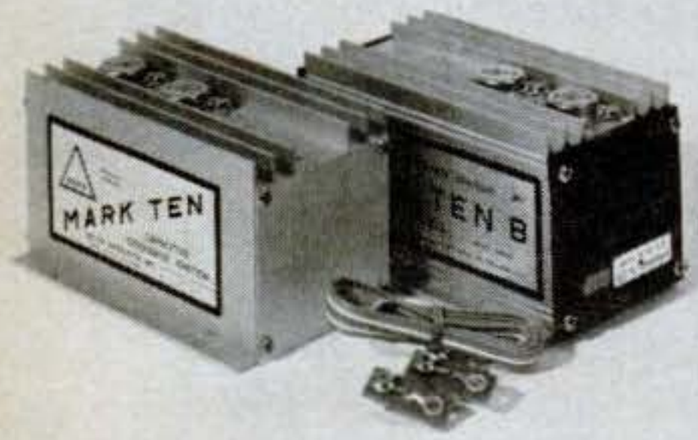
Mail Order to:

Dur-Tek Abrasive Corporation
P. O. Box 2026
Petersburg, Virginia 23803

CLIP & MAIL

Copyrighted material

Tune Out Tune Ups



Discover how a Delta Mark Ten or Mark Ten B Capacitive Discharge Ignition System on your car can eliminate 3 out of 4 tune ups. Write for complete information today.

DELTA PRODUCTS, INC.
P.O. BOX 1147 • GRAND JUNCTION, COLORADO 81501
PHONE (303) 242-9000
Dept. PS

Crisp Bacon in 90 Seconds

with
INTERNATIONAL'S MICROWAVE OVEN

People on the go will welcome an oven that makes cooking chores a pleasure. Imagine a "piping hot" TV dinner (frozen) in 3½ minutes* instead of 20 to 50 minutes. Bake a potato in 5 minutes* instead of 60 minutes. Fry crisp bacon in 90 seconds on a paper plate. Great for those leftovers. Countertop designed. Works on 115 vac house circuit. Write for folder.

**Times are approximate*

INTERNATIONAL
CRYSTAL MFG. CO., INC.
10 NO. LEE • OKLA. CITY, OKLA. 73102

Bartlett Flying Saucer ultra-light hovercraft powered by ordinary lawn mower engine—easy to build—fun to fly—complete plans, kit brochure, photos and supply sources $5.00. All orders returned via airmail. Write:

HERB BARTLETT
Box 3339-S, Scottsdale, Arizona 85257

MOLDS

for making Ornamental Concrete Items...

Book about Aluminum Molds with prices and production trade secrets direct from world's largest mold manufacturer.

SEND $2.00

CONCRETE MACHINERY COMPANY, INC.
P. O. BOX 99 • HICKORY 7, N. C. 28601

Buy Gov't Surplus
SAVE To 85%

Send 25¢ For Big Bargain Catalog
1000's Of Bargains; Surplus, Excess Inventory, Brand Name Equipment
COMPRESSORS • WINCHES • GEAR MOTORS
HYDRAULICS • SCREW JACKS • CB RADIOS
TELEPHONES • WELDERS • POWER PLANTS
SURVEYING INSTRUMENTS • ELECTRONICS
AIR TOOLS • TAPE RECORDERS • TARPS
WALKIE-TALKIES • PUMPS • BINOCULARS
"SATISFACTION OR MONEY-BACK GUARANTEE"

SURPLUS CENTER PS-072 Lincoln, Nebraska Zip Code 68501

HEARING AIDS

Huge savings on tiny, all-in-the-ear, behind the ear, eyeglass and body models. New space age models are so tiny and well concealed your closest friends may never even notice. FREE HOME TRIAL. Low as $10 monthly. Money back guarantee. Order direct and save. Write today for free catalog and confidential booklet.
PRESTIGE, Dept. T-28, Box 10947, Houston, Tex. 77018.

5-in-1 MINIATURE MACHINE SHOP

UNIMAT

VERSATILE UNIMAT converts from precision lathe to vertical mill, drill press, grinder or polisher. Easy to use. Make all small precision parts—for models, guns, cameras, inventions $169.50, ready-to-use. Send for free details. (Available in Canada.)

AMERICAN EDELSTAAL, INC. AG-2
1 ATWOOD AVE., TENAFLY, N.J. 07670

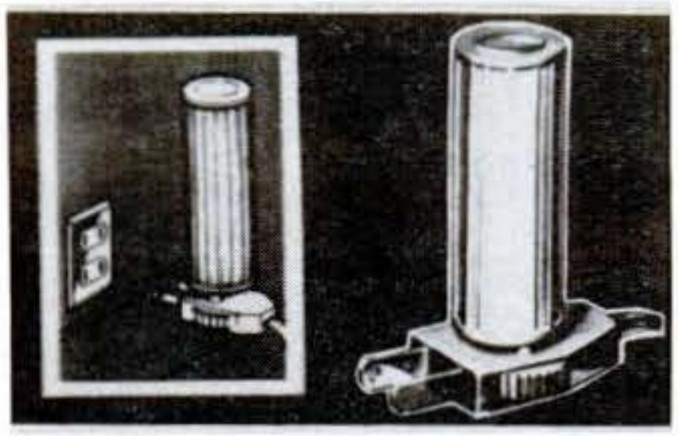
ELECTRIC ARC WELDER $9.99!

NATIONALLY ADVERTISED $18.95 VALUE! —NOW ½ PRICE! WELDS — BRAZES — SOLDERS — CUTS — MOST METALS! Plugs into **ANY** 110 volt socket. **MAKE — REPAIR 1001** items for **CAR—HOME—BUSINESS.** Lifetime **BURNOUT GUARANTEE**—10 day money back trial (if retnd). **HEAVY DUTY** Design. No experience needed—**FREE WELDING LESSONS!**

SEND ONLY $2.00 (cash, ck, M.O.) and pay postman $7.99 COD postage or send $9.99 plus $1.00 postage for paid del. in U.S.A. **COMPLETE READY TO USE**—Includes **BIG** pack steel, Brazing, Solder, Carbon "touch" rods. **ELECTROFLAME ARC TORCH! OFFER LIMITED**—Order **TODAY! MIDWAY WELDER, Dept. EPS-7 Kearney, Nebr. 68847.**

Shoppers'

"HOW TO GET THE MOST OUT OF BOATING." A comprehensive guide for the boater. Covers points such as boat constructions, boat selection, tides & currents, navigational aids, chart reading & weather & much more. Also lists nautical terms & rules of the road. This booklet is available FREE at your local Chrysler/Marine dealer.



USE HOUSE WIRING as a giant TV antenna. An electronic invention that will let you tune every TV channel in your area sharp & clear without indoor or outdoor antennas. Attaches to TV, plugs into electric outlet. Uses no current. 100% safe. Instructions included. Model # 4250, $1.98 + 25¢ pstg & hdlg. Foster-Trent, Dept. 555-TV, 2345 Post Rd., Larchmont, N.Y. 10538.

A BUSINESS OF YOUR OWN
REPAIR HYDRAULIC JACKS

Earn while you learn at home. Millions of jacks in gas stations, trucking firms, etc. need servicing. We show you HOW. Start spare time in your basement or garage. Big opportunity for mechanics.

write for folder No. PS7 and free bonus offer
HYDRAULIC JACK REPAIR MANUAL CO., INC.
G.P.O. BOX 3 • STATEN ISLAND, N.Y. 10314

HERNIA BRIEF

New, from England . . . no metal parts . . . light, comfortable and hygienic. Has Miracle Adjust-A-Pad—allows instant pad adjustment. Wear this modern support and *forget about your hernia.* 10 DAY FREE TRIAL — NO CASH NECESSARY — YOU PAY ONLY ON SATISFACTION. Send for full details.

SURGICAL INTERNATIONAL INC., Dept. 38
Box 24, 403 Kennedy Blvd., Somerdale, N.J. 08083

BULLDOZE, MOW, PLOW SNOW with man-size Economy Tractor

No toy — real workpower to landscape, plow, rototill, cultivate, haul, load. 14 hp engine with all-gear drive (no belts or fluid-drive loss), plus extra size, weight, and traction, give added power. Most for your money. Send for catalog, prices, dealer name. C-22

ECONOMY TRACTOR
1005 A-7 Anoka Ave.
Waukesha, Wis. 53186

AMAZING OFFER

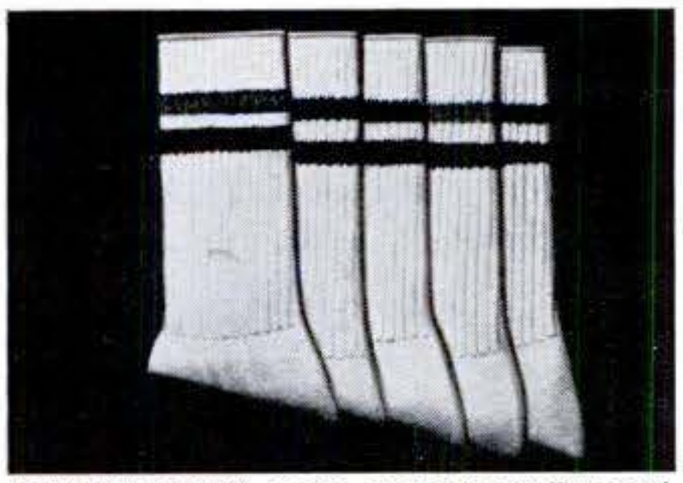
GUARANTEED 10 YEARS

DISCOUNT SALE! For hunters & fishermen. A knife, saw, hatchet, fish scaler and hammer. Rugged 9½" knife. 5" blade. **$3.98**

LAMINATED leather handle. Rich leather belt sheath contains honing stone, leg ties. Imported. *IF BROKEN WITHIN 10 YEARS WE WILL REPLACE FREE!* Use 30 days—if not pleased return for refund. **Regularly $5.99. Now only $3.98** plus $1.02 postage & handling. Send $5.00 today! MIDWEST KNIFE CO., Dept. SUR-7316, 90438, Western Ave., Chicago, Ill. 60620. Established 1936. Mail orders only!

Copyrighted material

Showcase



NEW ATHLETIC socks guaranteed 5 years! Handsome stretch crew socks with cushioned soles for extra comfort. And if you should ever wear out a pair in the next 5 years, Jay Norris Corp. will replace them free. White with stripe top. Fit sizes 10-13. 6 pr.—$4.98 + 70¢ pp-hdlg. 12 pr.—$8.98 + $1 pp-hdlg. Jay Norris Corp., Dept. WV-72, 31 Hanse Ave., Freeport, N.Y. 11520.

DEVELOP POWER PACKED MUSCLES in just minutes a day. Bullworker 2 will help put you into shape. Use at home, in the office, anywhere. Strengthen arms, legs, back, chest. Built-in powermeter lets you measure muscle power g-r-o-w-i-n-g from the very first day. Send for free booklet. No obligation. Bullworker Service, Dept. BW-278, 175 Community Dr., Great Neck, N.Y. 11021.

FIND BURIED TREASURE

Powerful electronic detector finds buried gold, silver, coins, etc. 5 new models. *Write for free catalog.*

RELCO, Dept. D-8 **19.95 up**
BOX 10839, HOUSTON, TEX. 77018

EASIEST WAY WITH TOOLS

George Daniels' HOW TO USE HAND AND POWER TOOLS gives you all the word-and-picture info you need. Discover new techniques and tricks for building and repairing with every important workshop tool. 22 big chapters, 325 illustrations. Hard-gloss paper cover.

Satisfaction guaranteed or money back. To order send check or money order for only $1.95 to: POPULAR SCIENCE/OUTDOOR LIFE BOOKS, Dept. P772, P.O. Box 226, Manhasset, N.Y. 11030

BUY BELOW WHOLESALE

Buy at factory prices! Why pay more? We buy direct from a thousand factories. And you, dealing thru us, can buy practically anything at factory price plus a small 6% service charge. All the best known name brands at unbelievable savings. You deal only with us! Send card for free details. No obligation. **AMERICAN BUYERS, Dept. PS., P.O. Box 848, Buffalo, N.Y. 14240**

SPLIT-IMAGE TRANSIT

The Most Revolutionary LEVEL & INCLINE MEASURE Ever Made!

IDEAL FOR: Contour Plowing, Carpentry, Brick Laying, Cement Work, Surveying, Etc.

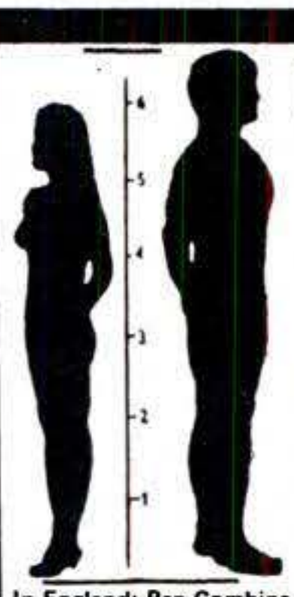
$10.95 plus $1.25 pp.

leatherette case **$3.95**

This simple yet amazingly accurate instrument indicates level and measures incline down to a fraction of an inch. Makes bubble type or string levels obsolete. It not only indicates level, but shows exactly how much correction is needed. Just one person, using the split-image transit and target supplied with it, can perform any levelling, incline-measuring job quickly, easily, accurately—measures inclines down to the thinness of a dime at 25 feet.

Send check or M.O. No C.O.D.'s. Satisfaction Guaranteed

J. W. HOLST, Inc. Dept. PS-772, 1005 E. Bay St. East Tawas, Mich. 48730.



BE TALLER!

BE TALLER! Girls go for tall Men.

If you could grow 2-6 inches taller in one month would you spend 25c to discover how?

Fantastic, new breakthrough method of increasing height quickly, safely and naturally. No exhausting exercise, appliances, drugs or elevators. PLUS, results guaranteed. Air mailed Proof 25c.

STATURE – HOUSE
P.O. Box 146-11519
Brampton, Canada

In England: Pan-Combine
24 Pembridge Rd.,
London W11

BUILD YOUR OWN BOAT & SAVE

★ BOAT PLANS ★ FRAME KITS ★
★ FULL SIZE PATTERNS ★

SEND $1 FOR 96 PAGE CATALOG NOW!

GLEN-L 9152P ROSECRANS BELLFLOWER, CA 90706

PORTABLE STEAM CLEANER

"Steam in 60 Seconds"

CLEAN— engines, large or small lawn mowers—air filters

3 year guarantee on coils & firebox. Uses liquid soap —weighs 120 lbs.

WEDCO MFG., INC., Dept. S-1, Box D, Jackson, Wyoming 83001

PLAY GUITAR IN 7 DAYS

OR YOUR MONEY BACK!

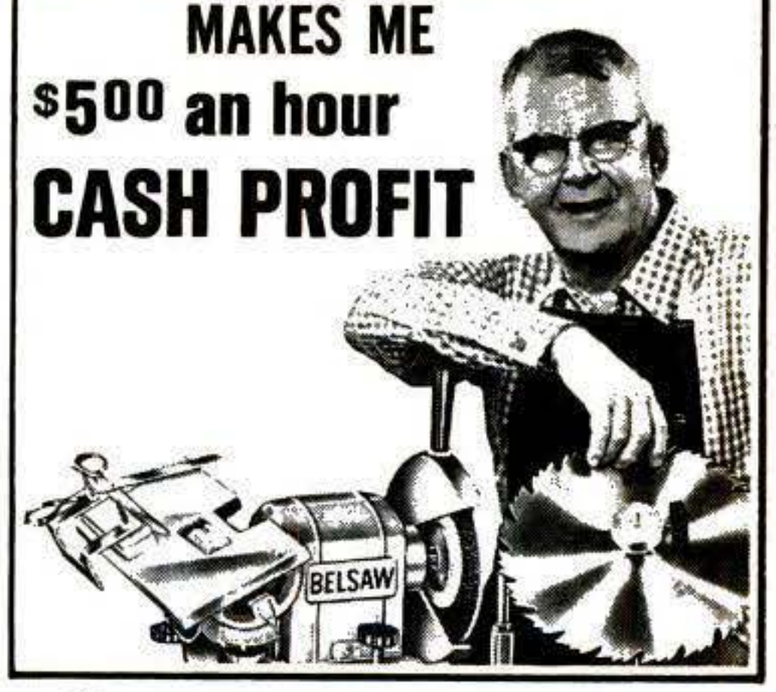
ED SALE'S famous Secret System worth $4.00 shows you how to play a beautiful song the first day, any song by ear or note in seven days! Contains 52 photos, 87 finger placing charts, etc., plus 110 popular and western songs (words and music; a $1.00 Chord Finder of all the chords used in popular music; a $3.00 Guitarist Book of Knowledge; and the extra special $1.00 value NEW wallet size Tuning Device for tuning any guitar by ear.

Total Value $9.00—Now $2.98 SEND NO MONEY!

Just send your name and address. On delivery pay postman $2.98 plus C.O.D. postage. Or send $2.98 plus 25¢ shipping and handling charges with order to save C.O.D. costs. (Sorry, no C.O.D. outside Continental U.S.A.—remit with order.) Money back guarantee.

ED SALE Studio 354-H, Avon By the Sea, N.J. 07717

MY SPARE TIME HOBBY MAKES ME $5.00 an hour CASH PROFIT



START YOUR OWN SPARE TIME BUSINESS. You can turn your spare time into Big Cash Profits with your own **COMPLETE SHARPENING SHOP** . . . Grind saws, knives, scissors, skates, lawn mower blades . . . all cutting edges. Your Own Cash Business with no inventory . . . right at home . . . no experience needed.

FREE BOOK tells how you can start your own spare time business while you are still working at your regular job. Low Cost – time payments. **30-Day Free Trial.**

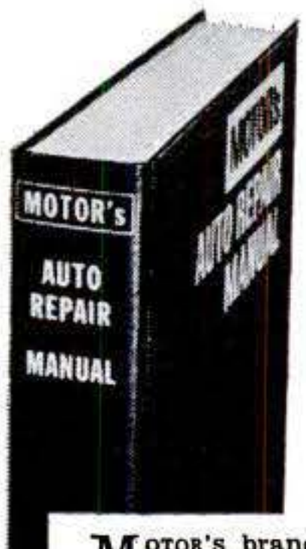
FREE BOOK

Just Mail Coupon—No Salesman Will Call

BELSAW SHARP-ALL CO.
703K Field Bldg. Kansas City, Mo. 64111
Send details of FREE TRIAL OFFER and Free Book "Lifetime Security." No obligation.

Name_____
Address_____
City_____
State_____ Zip_____

SEE how you can FIX CARS FASTER



with MOTOR's great 2-IN-1 AUTO REPAIR MANUAL

1. **Famous illustrated MANUAL shows how you can FIX just about any part of 2,300 Car Models, 1966-1972, including Compacts.**
2. **TROUBLE-SHOOTER Section and detailed trouble-shooting information thruout help pinpoint any of 4,200 car troubles.**

MOTOR's brand-new 1972 2-in-1 Manual practically does every repair job for you. Turns beginner mechanics into experts with time and money-saving tips. Over 1,000 big pages, over 3,000 how-to-do-it pictures. Much more. Only $10.95. Try it free for 10 days. If not fully satisfied, return book. Or keep it and pay the total price in three monthly installments, plus shipping charges. Cut out this ad and mail to:

MOTOR Book Dept., Desk E127
P.O. Box 2316, F.D.R. Station, New York, N.Y. 10022

☐ I'm enclosing payment in full. You'll pay shipping charges. (Same return privilege, refund guaranteed.)

Print Name.....
Address.....
City, State.....Zip.....
Signature please.....Age.....

Prices slightly higher in Canada. Offer available only in continental United States. Delivery will normally be within 3-4 weeks in Eastern U.S. Please allow longer west of the Mississippi.

INVENTIONS—NEW PRODUCTS—IDEAS

DEVELOPED & PREPARED
For Commercial Appeal & Sales
DESIGN—MARKETING—PATENT RESEARCH—DRAWINGS
Second Decade of Reliable Service to
INVENTORS • MANUFACTURERS • LAWYERS
Director: Raymond Lee
United States Patent Office former Patent Examiner
United States Department of Army former Patent Adviser
Member: United States Council, International Chamber of Commerce

—FREE CONSULTATION—
THE RAYMOND LEE ORGANIZATION INC.
230-H Park Ave., New York City 10017 212 MU 6-8500
SEND FREE *"INVENTION RECORD" Form "PRODUCT MARKETING" Brochure*

Name .....
Address .....
City..... State..... Zip.....

Copyrighted material

CLASSIFIED
OPPORTUNITY MART

CLASSIFIED ADS $1.90 per word, per insertion, payable in advance. Minimum ad, 10 words. Standard setting, first word in capital letters, rest of ad upper & lower case. Additional capitalized words, 70c per word extra. All capital letter headline or white space, $10.50 per line.

CLASSIFIED-DISPLAY ADS sold in units from 1 to 6 inches. Rate $150 per inch, per month. Discounts for continuity. (Complete details on request.)

Advertisers using a P. O. Box number in ad must furnish complete name and street address for our records.

CLOSING DATE for the September issue on sale August 29 is July 10.

Send all classified orders, copy, inquiries, etc., to: M. Coughlin, Classified Advertising Mgr., Popular Science, 355 Lexington Avenue, New York, N.Y. 10017.

1 AUTOMOBILES & MIDGET CARS

1970 - 1971 CHEVROLETS, Fords, Dodges from $799 to $999. Free Catalog. Pan Am., WV-35 Hanse Ave., Freeport, New York 11520.

CLASSIC T-Bird '55-7 headquarters, smartest sportscar investment you can make. Cars, parts "everything for the birds" in NEW 1972 catalog. Owners and owners to be "BIBLE" sent postpaid $6 with credit good first order. SHELL'S buys, swaps, ships anywhere. Box 767P, Santa Monica, California 90401. (213) 393-9840 Rush Orders.

2 AUTO SUPPLIES & EQUIPMENT

AUTO REPAIR RAMP. Raise car 8½ inches. Pair safely supports 3000 lbs. Disassembles easily for compact storage. Build yourself from lumber, $10/pair. Complete plans and instructions, $1.00. R. Agreen, Box 3139, Newport, Wilmington, Delaware 19804.

UNIQUE solid state theft deterrent sounds horn continuously with any significant electrical disturbance and car will not start. Simple two wire connection protects hood, trunk, doors, and power tailgate. Only $9.95. Solid State Electronics Co., Inc., P.O. Box 808, Clifton, New Jersey 07013.

NEW tires and tubes. Hundreds of name brand bargains. Savings up to 50%. B.F. Goodrich, Firestone, Medallion, Pirelli, others. All sizes and types. Manufacturer's guarantee insures quality. Catalog $1.00 (refundable). Tri-Pod Enterprises, Pouch PJ, 38 Mile Richardson Hwy., Fairbanks, Alaska 99701.

HOT Rodders, Dragsters! Compute hp, rpm, gear ratio, etc. Send $1.97 Guaranteed. Calculator, 302 Robin Hill Dr., Altamonte Springs, Florida 32701.

AUXILIARY battery isolation system. Charge auxiliary battery during vehicle operation; isolate auxiliary accessories. Boats, automobiles. Solid state. Guaranteed. $10.95 Check, money order. Charlton C.Lo Company, P.O. Box 975, El Cerrito, California 94530.

REVINYLIZE YOUR CAR TOP. Add resale value to your car. FINISH-R and complete kit only $9.95. Free gift with order. Panama House, Dept. 21, Rt. 2, Box 507-D, Panama City, Florida 32401.

MOTALOY $5.35 . . Two treatments $9.40 Postpaid. . . . Targus Enterprises, 2113 Atlantic, Virginia Beach, Virginia 23451.

DELCO Car Radios, AM Broadcast, 12 Volts, 100% Transistor. Speaker included. 30 Day Guarantee. $19.95 Postpaid. Joe Wilkerson, 1826 Cypress, Irving, Texas 75061.

MOTALOY, Ring - Valve job while driving - $6.00. Literature. E&G Sales, Box 18384F, Memphis, Tennessee 38118.

RING-Valve Job while driving, $6.50 postpaid. (Two—$12.00) . . . Established 1951 . . . Results Guaranteed!! Motaloy, Grantham 5, Pennsylvania 17027.

AUTOMOTIVE TUNE-UP KITS. Remove Carbon, sludge, gums, lacquers, cleans engine cooling system, transmission parts while you drive, neutralize engine acids. $12.00 postpaid. Shore Petrochemical, Box 96, Fairview Village, Pennsylvania 19409.

MODEL "A" Ford Parts. Full line, Fast Service. Send 35c for illustrated Catalog. Masonville Garage, Box 57-PS, Masonville, Iowa 50654.

AUTO ELECTRIC POWER for Tools

110 Volt D-C ELECTRICITY From a CAR'S ALTERNATOR

Installs on most late model cars, trucks or tractors. Operates power tools, light bulbs, heating devices, etc. Battery charging. *Checks or Money Order* **$16.95** WITHOUT 150V D-C METER **$19.95** WITH 150V D-C METER. Postage $1.25; Texas Res. only add Sales Tax.

AUTO AIR EQUIP., INC.
P.O. Box 2886 PS
Amarillo, Texas 79105

FREE 68 PAGE CATALOG

JEEP OWNERS • CAMPERS • HUNTERS • FISHERMEN

THINGS YOU'VE BEEN LOOKING FOR AND SOME YOU'VE NEVER SEEN!

FLOTATION TIRES & UNIQUE CAMPING ACCESSORIES

INCLUDE ZIP CODE – FOREIGN & AIRMAIL REQUESTS $1

DICK CEPEK 9201 CALIFORNIA AVE Dept PS SOUTH GATE CALIFORNIA 90280

DON'T Wax. Use Astroshield. No Wax. Free Sample. Buckel, R.D. #3, York, Pennsylvania 17402.

120 VOLTS at 3000 WATTS of electricity from ANY alternated vehicle! Operate drills, saws, wrenches, heaters, and many more ac devices! Arc weld up to ¼" steel! Series or parallel charge 6, 12, 24 volt batteries! Will not harm alternator! Ten minute installation! Guaranteed one year! Send only $6.95 for complete construction plans—only $19.95 postpaid for assembled adapter with light (automatically comes on when alternator produces 120 volts!)—plus many more useful products! Ask for FREE catalog—Creative Products, 1551 East Loop 820, Dept. S7, Fort Worth, Texas 76112.

REFINISH your vinyl car top. RefinishR renews, recolors tops like new. Specify color. Order now, Free tackle box with order. $9.95. Ivy Gifts, Dept. 301, 10343 Central, Indianapolis, Indiana 46280.

WHEEL BALANCERS
Bubble Type
$14.95 to $24.95

For wheels with center holes up to 6" in dia. Also Saab, all V.W.'s, Renault, Peugeot, Citroen & small trucks.
Send for detailed information and illustrations.

JACOBSEN MANUFACTURING
P. O. Box 6143PS 15025 Pacific Hwy. So. Seattle, Washington 98188

NEVER LOSE YOUR CAR GAS CAP AGAIN!

THE NEW CONCEPT GAS CAP

- Nozzle inserted through cap for filling
- Self seals when removed
- Insures proper fuel system venting
- Eliminates wasteful splashback from automatic shut off pumps
- Flame resistant synthetic rubber
- Easy, No tool installation

Choice of red, green, blue, black
State make, model, year, color
Not yet available for 71 & 72 models

Only 1.98 Postpaid
RLM Products Box 18302
Indianapolis, Indiana 46218

3 AUTO TRAILERS & CAMPERS

CAMPER Spare Tire Carriers. Camper Battery Carrier. Pick-up Tire Carriers. Motorcycle Carriers, and Motorcycle Jack. Wholesale Prices, 25c for illustrated brochure (refundable). Kenco, 6329 Jaynes Street, Omaha, Neb. 68104.

CABOVER Campers. Pick-up covers. 16' & 20' Trailers. Build and save. Large scale plans and full-size patterns with written & pictorial instructions. Complete accessory and aluminum covering kits. Free literature. Glen L. 9152PS7 Rosecrans, Bellflower, California 90706.

DETROIT APPROVED—PICKUP TANKS

Original equip. type poly. now avail. in aux. tanks for pickups. Increase gas capacity 40 gals. Easy 1 hour installation—completely hidden—no body work necessary. Let truck discounts pay for tanks.

R.P.M. INC., Dept. PS-7
P.O. Box 7936, Waco, Texas 76710

4 MOTORCYCLES, BICYCLES & SUPPLIES

BICYCLES—Repair parts for most Brands. Hard to get accessories. Tools. Catalog, send 25¢. Action Accessories, Box 15, Liverpool, New York 13088.

MOTORCYCLE: Plans and instructions for Do-It-Yourself Timing Kit. $1.00. Cyco Cycle Publications, P.O. Box 1176, Indio, California 92201.

BUILD "Popular Mechanics" MINI-BIKE featured June 1967 issue. Detail plans, photographs $2.50 refundable. Kits, parts, engines; factory discount prices. Catalog 25c. Gilliom Mfg.; PSC; St. Charles, Missouri 63301.

FUN CYCLE three wheel All Terrain Cycle. Designed and Tested by Recreational Vehicle Industry Engineers. Complete plans and specifications $2.00 (refundable). Kits available from $29.95. Ward Enterprises, Dept. PS7, P.O. Box 308, Chardon, Ohio 44024.

ILLUSTRATED Catalog 25c. Parts accessories, custom stock, most makes models. Cycle Supply, Box 192S, Fairbury, Illinois 61739.

Easy to Build PLANS AND INSTRUCTIONS for

GO KART	$2.00
MINI BIKE	$2.00
MINI CAR	$3.00
PEDAL BOAT	$4.00
SAIL BOAT	$2.00
SNOWMOBILE SLEIGH	$3.00

MINI VEHICLES PLANS
Dept. A, P.O. Box 92
Chazy, N.Y. 12921

5 AVIATION

ALL About Ballooning. Handbook $3.00. Aerostat, Box 141, Long Sault, Ontario, Canada.

DIRIGIBLE Build and fly 12' long remote controlled airship. Plans and book $5.25. LTA Products, 15 William Street, Closter, New Jersey 07624.

AIRBOAT. Propellers, Engines, Hubs, Mounts, Plans, Supplies. Corvair, V-W Conversions. 15, 20, 25 H.P. Removeable air drives. Kit airboats $450.00 up. Hovercraft Engines, Hubs, Propellers, Gyrocopter Propellers. Catalog $1.00. Banks-Maxwell, Box 3301G, Ft. Worth, Texas 76105.

STRAP-ON WING. One Man. Flown A lot. But IN GOOD CONDITION. $195. Delivered. Details $1. Shannon, Box 53, Paramount, California 90723.

PROPELLERS for gyrocopters, airboats, sleds, hovercraft. Low prices. Quantity discounts. Finest made. Free brochure. Aerial Propeller Co., Box 692, Greenville, Texas 75401.

SKIPPER Hovercraft Plans, $5.00. Twin Engine Hovercraft Plans, $10.00. Kits, Engines, Propellers, Accessories. Catalog, $1.00. Arrowcraft-SG, Pearland, Texas 77581.

5A HOVERCRAFT

PRACTICAL DESIGN GUIDE for Airboats and ACV'S. Send $5.00 to Palmer Aero-systems, P.O. Box 1892, Coral Gables, Florida 33134.

HOVERCRAFT plans all sizes, types; tested designs. Photos, information $1.00. Universal Hovercraft, 2611 182nd Place, Redondo Beach, California 90278.

SENSATIONAL SAUCER-SHAPED Hovercraft. All fiberglass, split-wing portability (no trailer required). Speeds to 35 MPH. 250 pounds payload. From $595.00. DEALERSHIPS AVAILABLE. Also, two place HS-II, plans—$10.50. Single place HS-IA, Plans—$6.00. Specifications, photographs (all models)—$2.00. Hoversport, 313 Balsam, Palm Beach Gardens, Florida 33403.

HOVERLOG '72—The Complete Hovercraft Catalog! Books, Plans, Fans, Ducts, Supplies, Materials, Complete Vehicles, Kits, Accessories. $2.00 For Full Catalog. Venture Aero-Marine, Dept. 106, Box 5273, Akron, Ohio 44313.

AERO-CAR
AIR CUSHION VEHICLE

Amazing hovercraft built easily with ordinary tools.

- LAWNMOWER ENGINE POWERED
- CARRIES ONE MAN AND MORE
- FLIES OVER LAND/SNOW/WATER
- FORWARD, BACKWARD, SIDEWAYS AND HOVERS!

Complete Construction Plans and Book

Aero Projects, **$5.95**
Box 5118PS,
Clinton, N.J. 08809 PPD

6 ASTRONAUTICS

ANTIGRAVITY DEVICE. Brochure 35c. AGD, Box 3062-PS, Bartlesville, Oklahoma 74003.

ROCKETS: Real flying models—flights up to 2500 ft. New illustrated catalog 25c. Single and multistage kits, cones, engines, launchers, trackers, rocket aerial cameras, technical information. Fast service. Estes Industries, Dept. 32-A, Penrose, Colorado 81240.

ROCKETS! ! ! Giant new catalog—twelve new flying kits—engines—(safety certified)—flights over 2,600 feet. Send 25c for catalog—refunded with first order. Fast delivery. Centuri Aerospace, Dept. Q42—C, P.O. Box 1988, Phoenix, Arizona 85001.

THE Uncle Russell Space Club. Free Details. Uncle Russell Cape Canaveral Launch Center, P. O. Box 412, Merritt Island, Florida 32952.

7 BOATS, INBOARD & OUTBOARD MOTORS

FREE Catalogue-plans, kits: canoes, sailing canoes, kayaks, row-motor-sailboats, cruising sailboats. Quicksilver, 255B Shamrock Blvd., Venice, Fla. 33595.

CANOE Kits—Wood Canvas, Molded Fiberglass—Free Catalog. Canoe—Camping Log Book $1.00. Trailcraft Inc., Box 6062, Concordia, Kansas 66901.

BOAT Kits. Molded Fiberglass. Save money—assemble yourself. Factory molded sections bond into one-piece craft. 20 Models—14' to 32' Cruisers, Runabouts, Houseboats, Sailboats. Big line accessories, motors, trailers. Easy terms. Free 80 page catalog. Luger, Dept. AF-72, 3800 West Highway 13, Burnsville, Minnesota 55378.

PRAM kits $49.95. Canoe, kayak kits. 250 plans, patterns, kits. Catalogs: Powerboat (2), $1.25, sailboat 50c. Camper trailer plans. Marinecraft, Box 161P, Brighton, Massachusetts 02135.

FIBERGLASS. Resin, Foam, Brass, bronze screws. Prepaid, no tax. Boat plans Catalog 25c. Stiles, 11-S Mantua Hts., New Jersey 08051.

FIBERGLASS Canoes. Four Exciting Models. Easily Assembled Kits. $39.95 up. Factory Direct. Free literature. Riverside Canoes. Box 5595-C, Riverside, California 92507.

INFLATABLE Boats And Life Rafts (Avon, Zodiac, Winslow, Etc.), Revere Inflator, Fire Fighting Equipment, Distress Flares, Life Jackets and Cushions. Plus Many More Items. Catalog 25c. Send To Revere Survival Products, Dept. PS, 605 West 29th Street, New York, New York 10001.

Copyrighted material

COMPETITION Marine Equipment! Over 300 items for complete auto conversions and installations in high performance SK and ski boats. Mail $1.00 for new 72-page catalog complete with photos, specifications and prices. Glenwood Marine, Dept. PS, 1627 W. El Segundo Blvd., Gardena, Calif. 90249.

NEW 1971 Outboards . . . Top Brands . . . 4 H.P. $139 . . . 6-$273 . . . 18-$399 . . . 40-Electric $638 . . . 60-Electric-$899 . . . All Sizes . . . Literature 50c. Scott-McCulloch Parts. Electra Marine, 675 Merrick Rd., Lynbrook, N.Y. 11563.

PLANS, Full-Size Patterns, Frame Kits with step-by-step instructions specially for amateurs. Send $1.00 for new catalog just off press—nearly 100 pages, over 100 designs 8' to 42': Sail Jets, Inboards, Outboards, Cruisers, Houseboats, Hot Boats, Catamarans, Hydros. Glen Marine, 9152 Rosecrans, Bellflower, California 90706.

FIBERGLASS cloth, mat, resin, Flotation foam. Complete supplies. Catalog 25c. Kick-Shaw, Inc., 3511 Hixson Pike, Chattanooga, Tennessee 37415.

MARINE Engines, conversions, parts, equipment. Catalog Free! Stokes Marine Industries, Coldwater, Michigan 49036.

FREE Brochure Conversion Kits Propellers, Gears, V-Drives, 1/0 Drives, Gas, Diesel. Starmarine 1931 Embarcadero, Oakland, California 94606.

SAILBOAT KITS
Free color catalog of the largest selection of popular sailboats, iceboats, and sail making supplies.
TAFT MARINE CORP.
6512 Shingle Creek Pkwy
Dept. PS 7
Minneapolis, Minn. 55430

BOAT PLANS · KITS
World's largest catalog, over 200 top designs for the amateur. Inboards, outboards, sail, deep vees, 8' to 57' — hydros, cruisers, house boats, ferro cement, plywood. Send $1.00 for catalog or $2.00 for catalog plus Boat Builder's Guide.
FIBERGLASS MATERIALS
Factory to you prices. Save 60%—Fiberglass cloth, mat, roving (floatation foams, epoxy, etc.). Complete line—bronze boat nails, screws, glue, lumber, etc. Send $1.00 for literature or $2.00 for literature plus book on Fiberglass Repairs, Molds, etc.
FERRO CEMENT BOATBUILDING — $6.00
MOTOR INSTALLATION BOOK — $5.00
CLARK CRAFT BOAT CO.
16-PS Aqua Lane Tonawanda, N. Y. 14150

9 ELECTRICAL SUPPLIES & EQUIPMENT

PSYCHEDELIC Equipment—Catalog—Handbook. Send $1.00—One Trip Beyond, P. O. Box 2043-A, Dearborn, Mich. 48123.

ELECTROPLATING EQUIP.
Portable Platers, Supplies & "Know-How."
Build your own tanks for Nickel, Chrome, etc. Easy-to-install PVC liners. Rectifier components—all sizes. Schematic parts lists, formulas, operating instructions for all plating. Guar. to save 25%-75%. Some good used units for sale.
Send for FREE details.
PLATERS SERVICE CO.
1511-Y1 Esperanza Los Angeles 90023

10 WELDING, SOLDERING

MORRIS Welders—110/220, 170 Amperes, $59.50. 1070 Inner, Schenectady, New York 12303.

11 DO-IT-YOURSELF

HOME SECURITY and SAFETY book, featuring installation and procedure descriptions of burglar alarms. Send $1.00 to Bradley Electronics Inc., Dept. 104, 15 Gaval Road, Sayreville, N.J. 08872.

BURGLAR-fire alarms. Lowest prices. Catalog and instructions 50c. Gem, Dept. P, 6801-11th Ave., Brooklyn, New York 11219.

SAVE! Build-your-own Plans. Portable Electric Power Plant from used parts and 110 Volt power on your car. Information/photos $1. B-UR-O, 34161-B-GG-Coast Hwy., Dana Point, California 92629.

DEALERS wanted—Stop burglars with a "Protected by Delt Alert" reflectorized decal. Affix to area that needs protection. Only $1.00 for a set of two, or five for $2.00. With Delt Alert a would-be thief stays away. W.D. Kreitzer & Son, Distributor for Delt Alert, 15 Main Street, Box 218, Elliott, Illinois 60933. Telephone Number (217)749-2597. Dealer inquiries invited. Send for free literature and price list.

ARCHITECTURAL Design Course, complete. Design, build, your own home. Send $25.00. Maricopa Institute, Suite 609, 3443 North Central, Phoenix, Ariz.

PREVENT flat tires! Guaranteed Chemical Seals Punctures! Send $3.25. Wamoth, Box 5381, 1A7, Sherman Oaks, California 91413.

ALARM SYSTEM plans for building effective protection against burglary, fire, freezer failures, etc. Includes instruction plans for: 7 different system; 2 EMERGENCY POWER SYSTEM plans for lighting inside, outside home, and alarm backup using storage battery during power failures; and 3 cabinets. Includes materials list. Complete set $4.00. Ameriacn Conflux, Inc., Box 5704S, Redwood City, California 94063.

BURGLAR-Fire Alarm Supplies and Information. Free Catalog. Protecto Alarm Sales, Box 357 Birch Run, Michigan 48415.

WHOLESALE burglar alarm supplies. Catalog $1.00 (refundable). Ellin, 161-T Bonad, Chestnut Hill, Massachusetts 02167.

HAVE FUN! Make useful-decorative items for Home-Gifts-Profits . . . from the largest selection of RESINCRAFT, CANDLECRAFT AND RELATED SUPPLIES available anywhere. Illustrated catalog $1. (refundable). Specialty Products. Dept. E, 731 Brooks Road, Muskegon, Michigan 49442.

WATERBEDS: "Enjoy total relaxation". King, Queen, Double, or Single waterbeds, including mattress, liner, and easy plans for inexpensive frame, $29.95 plus postage. Prices 50c. Waterbeds, 7605 Ledford, Falls Church, Virginia 22043.

MEPS—Multiple Electric Power Supply: Build your own; AC or DC 10 Amp 0 to 130V filtered or unfiltered, in one piece. Power almost any tool at variable speed. Charge any battery, electro plate. Magnetize, or Demagnatize, many more. Complete Plans—$2.00. Nelsons Air Supply, Box 718, Belmont, California 94002.

NATIONALLY Known Lightning Protection Systems. Material and Instructions. Write "Robbins", Box 440, Maryville, Missouri 64468.

SCRATCHES and haze removed from unbreakable watch crystals. $1.25. CharNa, 158 Cherry St., Framingham, Massachusetts 01701.

CONVERT mower engines into air compressors. Write. Showalter, Box 409B, Abilene, Kansas 67410.

NEW Burglar - Fire alarm system kit $69.95. Easy to install. Complete instructions—Satisfaction guaranteed; Accessory catalog 25c. C.D.S., P.O. Box 790, Pearland, Texas 77581.

CARNIVAL Building Plans; Rides, Shows, Games, Illusions; 264 pages catalog. Refundable $1. Brill, Box 875-D, Peoria, Illinois 61601.

FIRE & BURGLAR ALARMS
1972 Handbook & Catalog

Save Hundreds of Dollars
Professional equipment from famous manufacturers. New and expanded to include laser photo-electronic systems, dialers, electronic sirens, perimeter controls and radio actuated systems that install in less than 2 hours. Save up to 75%. This handbook is a must for every homeowner and businessman. Just $1 cash, check or M.O. $1 refunded with first order.
ALARM COMPONENT DISTRIBUTORS
33 New Haven Ave., Dept. P.S.
Milford, Conn. 06460

BURGLAR Alarm. Professional supplies. Free Catalogue. Smith, 1601 SW 58 Ave., Gainesville, Florida 32601.

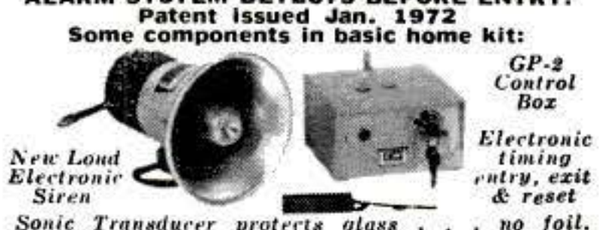
PREVENT Car Theft. New Autotronic theft guard makes hot-wiring impossible. Installs in minutes; no drilling, splicing. Money back guarantee. $6.95. Ivy, Dept. 302, 10343 Central, Indianapolis, Indiana 46280.

BURGLARY PROTECTION — Professional alarm system components, locks safes, accessories. Free catalog. TPC, Box AE-1, Cupertino, Calif. 95014.

BUILD YOUR OWN POOL
Save $1500 to $4000
Simplified & detailed—instructions, plans, specifications & drawings for block, concrete & pre-fab pools including filters.
The Complete Swimming Pool Construction Guide, $5.95
Satisfaction Guaranteed
SNAKE HILL CONSULTANTS
Averill Park, N.Y. 12018

PREVENT AUTO THEFT
AUTO GUARD—an Electronic Deactivator for use in Cars & Trucks. Prevents Theft by making it Impossible to Jump Starter, "Hot Wiring" Ignition, using Master Keys or Other Common Techniques of Theft.
Easily Installed in Minutes! Absolutely no Drilling, Wire Splicing or Alteration of Existing Wiring in Car. Full Instructions Included. Weight 3 Ounces. A MUST in View of the Alarming Increase in Car Thefts.

ONLY $6.95 EACH
RAFORD—Dept. 2A5
320 South Main, Niantic, Ill. 62551

Homes—Autos—Boats
NEW FOOL PROOF PARIMETER ALARM SYSTEM DETECTS BEFORE ENTRY!
Patent Issued Jan. 1972
Some components in basic home kit:


Sonic Transducer protects glass . . . no foil. Leaves inside of your home almost entirely free of messy wiring.
A TOTALLY DIFFERENT CONCEPT ON THE PRINCIPLE OF PROTECTING PROPERTY. Now pioneered to the highest degree of perfection. System can protect your home or business 24 hours a day while presenting no restrictions on normal activities to residents or pets inside protected area. Easy to install—battery powered—Trouble free. Order yours today—Qualify to become a dealer (For more information send $1.00). Basic home Kit: GP-2 control box $95.00, Transducer—$3.00 each (1 used per window or glass). Mag Switch for door $3.50 ea. Electronic siren $38.00 or 10" bell $16.00 AUTOMOBILE kit (a fantastic system): $84.00 includes siren, box, 5 transducers, key sw. etc. with instructions.
KING RESEARCH LABS, INC.
801 S. Eleventh Ave., Maywood, Ill. 60153
Phone: (312) 344-7877

12 HOME CRAFTSMAN

WOODWORKING Catalog and Manual 50c. Plus free "101 Project Ideas." World's most beautiful veneers, lumber, plywood! Wood finishing, upholstery supplies. Cane, Lamp parts. Furniture hardware. Animal Whittling blocks. 2,000 workshop products. Constantine 2053-C, Eastchester Road, Bronx 10461.

HANDYMAN Assortment: Nuts-Bolts-Screws Washers-Pins. 2 lbs. $3.35—4 lbs. $5.45—6 lbs. $7.65—12 lbs. $13.95 PREPAID. Snow Associates, Dept. PS, 112 No. Clinton, Chicago, Illinois 60606.

AWNINGS Fiberglass. Aluminum Frames, less than $4.00. Plans $1.25. Box 4330, Washington, D.C. 20012.

"CABINETMAKING Made Easy"—"Making Formica Brand Laminate Counter Tops". Two excellent guides let you build kitchen cabinets and "tops" like professionals. Extraordinary guides bring master craftsmen's short-cut methods. Satisfaction guaranteed. Write: Japs, 126-L Seventh North, Hopkins, Minnesota 55343.

WALNUT Mouldings, Bowls, Picture Frames, Lumber, Gunstocks, Squares. Midland Walnut Company, Dept. S, Box 262, Savannah, Missouri 64485.

CLOCK KITS, Movements, Dials, Frames. 1972 Catalog 25c Coin or Stamps. Newport Enterprises, Box 6848J, Burbank, California 91505.

FOUNDRYETTE 2400 F. 1½ to 48 lb. capacity. Circular 25c. Kansas City Specialties, Box 193, Middleton, Wis. 53562.

FREE: New handicrafts catalog. Supreme Handicrafts, Box 395-PS, Sioux Falls, South Dakota 57101.

"GETTING Started in Stained Glass." 25c. Whittemore, Box 2065X, Hanover, Massachusetts 02339.

ORNAMENTAL IRON WORK. Beautiful scrolls with inexpensive professional bender. Modular segments. Details free. Fuchslin, Box 472, Woodland, California 95695.

BE ORGANIZED
IF You save your copies of Popular Science, here's a great way to keep them from getting torn, dirty, etc. Heavy, quality-constructed file boxes hold a year's issues (new, large size format). Gold embossed. Only $4.25 each, postpaid. Order today from Jesse Jones Box Corp., P. O. Box 5120, Philadelphia, Pa. 19141.

13 TOOLS & MACHINERY

USED Machinery-Surplus Industrial Equipment. Trade Guns, Cameras, Cruisers, Airplanes. List 25¢. Specify Requirements. Anderson Equipment Corp., 799 Roosevelt, Glen Ellyn, Ill. 60137.

WHOLESALE Chainsaw Supplies. Name Brand Products—Fast Service. Mfg. Supply, Box 157, Dorchester, Wisconsin 54425. Dept. PS.

WOW! ½" Drill $19.95—Black and Decker. Fully Guaranteed. Prepaid—Six Drill Accessories—$5.95. State Auto, Box 6787, Columbia, S. C. 29206.

MAXIMAT, UNIMAT. Save at our low prices. Pioneer Electric, Box 7, Brentwood, New York 11717.

MAXIMAT, Unimat sale. Amazingly low prices. Deco-S, 562 Howard Avenue, Staten Island, New York 10301.

SMALL Foundry Furnace, Supplies. Free Literature. Pyramid Products, Dept. H, 3736 South 7th Avenue, Phoenix, Arizona 85041.

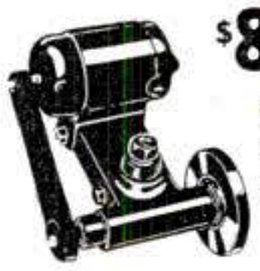
WINCHES and HOISTS. Choice of 12 volt or 110. Reversible, compact, fast. ¼ ton to 1 ton capacity, from $49.95. 25c brings 16 page full color catalog. Refundable. Superwinch, Inc., Dept. PS, Pomfret, Connecticut 06258.

SCREWS, Washers, Bolts, Nuts Assortments, Plumbing, Tools, Drills. 25¢ For Catalog. Nutty Co., Box 1576, SMS, Fairfield, Connecticut 06430.

MICROMETERS — Indicators — Steel —Aluminum—Brass, Maximat, Unimat Lathes. Complete mailing-50c. Campbell, 1424 Barclay, Springfield, Ohio 45505.

KWICK POWER FOR TOOLS
110 volts D.C. 3000 watts anywhere from any vehicle with an alternator. Installs permanently in 15 minutes. Operate heavy duty saws, drills, lights, heaters & many more a.c. devices. Arc weld, quick charge batteries. Will not harm alternator. $14.95 postpaid, check or money order.

Only $14.95
AUTO QUICK
10914 4th St., N.E., Minneapolis, Minn. 55434


$89.50 SURPLUS SALE
NEW TOOL POST GRINDERS
TODAY'S VALUE $225.00
EXTRA QUILL EXTERNAL OR INTERNAL $29.50
Write For Circular
Nolan Machinery Co., Pulaski, N.Y. 13142

14 ENGINES & MOTORS

GAS TURBINE ENGINE Starting Instructions. Ideal and most helpful to all gas turbine owners, engineers, experimental designers and hobbyists. D A C, $2.00. P.O. Box 4616, Hollywood, Florida 33023.

REWIND car generator for 110 V.A.C. power plant. Plans $2.00. R. Schmauss, 1228 E. Cass St., Tampa, Florida 33602.

Copyrighted material

18 CAMERAS & PHOTO SUPPLIES

FREE! Free! Bargain Book—Central Camera Co., Dept. 471, 203 S. Wabash, Chicago, Illinois 60604.

FAST, reliable projector and camera repair. Free estimates. Repairs guaranteed ninety days. Cahill Camera Service, 7119 Puritan Dept. PS, Detroit, Michigan 48238.

19 MOTION PICTURES

16mm 8mm SILENT & Sound Classics. Niles, 1019-PS South Michigan, South Bend, Indiana 46618.

16MM CLASSICS. Illustrated Catalog 25¢. Manbeck Pictures, 3621S Wakonda Drive, Des Moines, Iowa 50321.

FREE Catalogues, 5,000, 8-16MM Films. International-S Films, Greenvale, New York 11548.

175-FOOT 8MM PREVUE MOVIE . . . Only $1.99. See Laurel & Hardy, Chaplin, Fairbanks, Keystone Cops, Gish, Pickford, Chaney . . . comedy, drama, adventure, history from the silents! Taste the fun of great movies right at home! Order today . . . specify standard or Super 8. Free catalog. Blackhawk Films, #544 Eastin-Phelan Bldg., Davenport, Iowa 52808.

16MM SOUND Films. New, Used for Sale. Free Catalog. National Cinema, 333 W. 57th St., New York City, New York 10019.

FREE! 64-page catalog. 8-16mm film, supplies, processing, equipment. Superior, 442-448 N. Wells, Chicago, Illinois 60610.

8MM - 16MM DISCOUNT MOVIES! Free catalog! CINEMA EIGHT, Box 245PS, New York City 10028.

19A COLOR SLIDES

35MM, COLOR SLIDE SAMPLER . . . 20 "best" 2" x 2" . . . $1.00. Free catalog Hundreds of sets . . . travel, circus, wildlife, flowers, railroads, war, etc. Order today. Blackhawk Films, #545 Eastin-Phelan Bldg., Davenport, Iowa 52808.

ASTRONOMY — Space — Underwater slides. Free catalog. fmRE, Box 608, Dana Point, California 92629.

35MM COLOR Slides. 10,671 Individually Sold. Described Encyclopedia-Catalog 10c. Wolfe Worldwide Dept. 16-72, Los Angeles, California 90025.

20 PHOTO FINISHING, PHOTOCOPIES, ETC.

CAMERA FANS! Expert photofinishing by one of Country's largest labs at lowest prices. Fast Service and free "Foto-Fan" Stamps you quickly redeem for valuable Photo Supplies. 8MM Kodachrome $1.29; 8 Exp Kodacolor $1.79; 35MM Kodachrome, 20 Slides $1.39; 8 Exp. Black/White 69c. Satisfaction guaranteed. Send exposed film or request free mailers, complete Price List and Gift Catalog. Direct Mail Photo, Box 8352-PS, Pittsburgh, Pa. 15218.

21 HOBBIES & COLLECTIONS

HOBBI-CARVE—home workshop wood carver—create beautiful wood reproductions of sculptures, plaques, figurines, sconces and bookends. Hundreds of work patterns available. Send 25c for "How To Make Quality Wood Carvings" booklet. Refunded with order. Write: Hobbi-Carve, 930 Duluth Street, Dept. PS, St. Paul, Minnesota 55106.

NUMISMATIC Chessboard Kit. New, Unique. $2.98. Satisfaction Guaranteed. Coinland, Box 287, Malabar, Fla. 32950.

MILITARY Miniatures for War Gamers, plus 100 museum pieces for serious collectors. Catalog 50c. Bussler, Box 107-E, Wollaston, Massachusetts 02170.

FREE Pricelist. Worldwide Seashells. Box 13288, Tampa, Fla. 33611. Book $1.

BUILD your own reflector telescope. Esco is back. Do-it-yourself, reflector telescope kits. See the moon and stars. Mirrors and lens kits. Send for details. Esco Products, 171 Oak Ridge Road, Oak Ridge, New Jersey 07438.

23 MINERALS & PRECIOUS STONES

EARTH Science Rockhound Magazine subscription $3.00. Sample 40c. Box 550-PS, Downers Grove, Illinois 60515.

GOLD 10 Small nuggets panned from Oregon Streams $1.00. Robert Brandt, Sweethome, Oregon 97386.

23A COSTUME AND GEMSTONE JEWELRY

GET Free catalog no serious rockhound, gem cutter, jewelry maker, hobbyist or craftsman can be without. Full of bargains, exclusive items, low prices from largest suppliers and authorities in the field. Free new catalog just off the press, yours for the asking. Write: Grieger's, Dept. C-14, 1633 E. Walnut St., Pasadena, California 91109.

24 ANTIQUES, RELICS & INDIAN GOODS

IROQUOIS masks, Eskimo sculptures. Catalogues 25c. Iroqrafts, Ohswokon, Ontario, Canada.

SAVE Money! Know Prices to Buy and Sell Your Antiques. 224 Page Guide can Save You Dollars. Only $1.98. Maison Clarisse, Dept. SP-62, 700 Rural Street, New Orleans, Louisiana 70123.

26 SCIENCE & CHEMISTRY

LIQUID ROCKET: 3 Mile Altitudes! Plans, $4.98. Catalog, $1.00 (Refundable). Star Space Systems, PS24, Box 4605, Vancouver 10, B. C.

CHEMICALS, Apparatus, Biology and Model Rockets. Both Catalogs 50c. Sheard Science, Dept. PS, Columbus, Wisconsin 53925.

FREE Rocket Catalog. Rockets, Launchers and supplies. McCord Model Rockets, Box 41, Sylvania, Ohio 43560.

LASER Parts Catalog 60c. Moynihan, 107 North Brighton, Atlantic City, New Jersey 08401.

LASER MIRRORS
LOW Cost He-Ne. S.C.L. Products, P.O. Box 1002, Cupertino, Calif. 95014.

CHEMISTRY and biology supplies, catalog 35c. Boulevard Laboratories, 3114 East 83rd Street, Chicago, Ill. 60617.

FIBEROPTICS Fascinating, mystifying. Lamp-kits, face-plates, jewelry. Plastic, glass. Free catalog. Meshna, P.O. Box 62, E. Lynn, Mass. 01904.

JOIN JUNIOR SCIENTIST CLUB receive newsletter all for $4. -/year. Other equipment can be purchased at club rates. Newsletter 50c each. Box 581, Waltham, Massachusetts 02154.

ROCKETS: Real flying models—flights up to 2500 ft. New illustrated catalog 25¢. Single and multistage kits, cones, engines, launchers, trackers, rocket aerial cameras, technical information. Fast service. Estes Industries, Dept. 6-A, Penrose, Colorado 81240.

ROCKETS!!! Giant new catalog—twelve new flying kits—engines—(safety certified)—flights over 2,000 feet. Send 25c for catalog—refunded with first order. Fast delivery. Centuri Aerospace, Dept. Q42—A, P.O. Box 1988, Phoenix, Arizona 85001.

CHEMICALS, Apparatus, Biological-Scientific Supplies. Catalogue, 50¢. Hagenow Laboratories, Manitowoc, Wisconsin 54220.

AMAZING PSEUDOPLASTIC LIQUID CURIOSITY. $2.95 quart, postpaid. Pitt Scientific, 5826 John, Superior, Wisconsin 54880.

FIBRE OP-KITS. Using the "magical optical fibers" that transmit light energy. FREE CATALOG. Scientific Devices, 211P Albion, Wakefield, Massachusetts 01880.

LABORATORY Supplies At Discounted Prices! Catalogue - 50¢. Starr Scientific, Manitowoc, Wisconsin 54220.

LASER kit for the amateur scientist—complete optics, mirrors, crystal, tubing—write for instructions and free literature. Esco Products, 171 Oak Ridge Road, Oak Ridge, New Jersey 07438.

REAL ELECTROMAGNETIC ANTI-GRAVITY ROCKET, FLYING SAUCER. Plans, $2.00. NEEDLE-BEAM RAY PISTOL. Plans, $2.00. LIGHTNING-BOLT MACHINE. Makes lightning-bolts three feet long. Plans $2.00. TA, Box 1266P, South Lake Tahoe, California 95705.

CHEMICALS and apparatus for industrial, analytical and private laboratories. Catalog 50c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester, New York 14620.

LASER

Laser or Phaser Pistol plans—**$2.00 each, Postpaid.**

Catalogue—50¢

Roy Davis Laboratories, Dept. PS, 118 West Adams St., Jacksonville, Florida 32202.

27 PLASTICS

CASTOLITE pours like water, hardens like glass without heat. Crystal clear or colors. Embed natural flowers, other objects. Make fine gifts. Reproduce your own designs in plastics, wax, metal, plaster, cement, etc. Make flexible molds over any pattern, any size. Profitable. Manual 25c. CASTOLITE, 72H/PS, Woodstock, Illinois 60098.

FREE LITERATURE for sculptors showing how to make molds, cast plastics. Adhesive Products Corporation, 1660 Boone Avenue, Bronx, New York 10460.

FIBERGLASS Resins, Mat, Cloth, Roving for Molding, Layup. PLEXIGLASS Sheets, Rods, Tubes. Marine Plastics, P. O. Box 1844, St. Louis, Missouri 63118.

LARGEST Handicrafts Supply catalogue $1.00 (refundable). R.P.H. Mfg., 24-P7, Winter, Stamford, Conn. 08905.

30 GARDEN SUPPLIES & EQUIPMENT

bring joy to your little corner of the world...

Plant a tree for tomorrow!

For details, write:

The National Arbor Day Foundation
Box 100 Arbor Lodge
Nebraska City, Nebraska 68401

31 FLOWERS, PLANTS & NURSERY SUPPLIES

1,000 HORTICULTURAL Items—Propagation Supplies, Books, Seedings, Grafts, Seeds, Shrubs, Bonsai. Mellinger's, North Lima 39, Ohio 44452.

32 REAL ESTATE

IDEAL 5 ACRE RANCH LAKE CONCHAS, New Mexico. $2,975.00 No Down, No Interest, $25.00 Monthly. Vacation Paradise, Money Maker. Ranchos, Box 1095PS, Alameda, California 94501.

OREGON Coast:—Own your own mobile home space in planned mobile home city. New concept of land ownership. Not a subdivision. Golf, hunt, fish, ocean, rivers. $100 down, $35 p/m. no interest, free brochure. Surfridge, Box 772, Rte. 1, Bandon, Oregon 97411.

FREE . . . 256-page SUMMER catalog. Hundreds of top real estate values coast to coast! UNITED FARM AGENCY, 612-PS, West 47th St., Kansas City, Missouri 64112.

BOILING Spring Lakes—America's Greatest Real Estate Value. 1/3 acre vacation or retirement homesites only $750 cash price. Ten years to pay. Money-Back inspection guarantee. Carolina coast, multi-million dollar, 14,000 acre development, 50 fresh water lakes, private ocean beach, golf course, motel, and country club. Free literature. Dept. 2-X, Boiling Spring Lakes, North Carolina 28461. (Registered under Federal Land Sales act but not offered to residents of states requiring separate registration.)

COLORADO LAND KIT! Shows you the most spectacular land you've ever seen . . . in the heart of Colorado's famed high country! Contains brochure with 17 full color photos, map, information on fishing, hunting, riding camping. Explains how you may own 5 acres with no down payment, no interest, just $20.00 a month! This could be your investment and recreation dream come true. Send for free land kit to Aspen Lakes Ranch, Dept. PS-3, 1108 Alvarado, N.E., Albuquerque, New Mexico 87110.

ARIZONA—adjoining Prescott National Forest. Ideal year round climate. Two acres, perfect for home, cabin or mobile home $1,995, low terms available. G.E. Sweeney, Glenarm Land Co., 2233 No. 7th St., Phoenix 85006.

CANADIAN Vacation Lands; Full price $385.00, 40 acres, $10 month. Suitable cottage sites, hunting, fishing, investment. Free information. Land Corporation 3768-D, Bathurst, Downsview, Ontario, Canada.

CENTRAL Ontario—Choice 640 acre Sportsmen's paradises still available—$20.00 plus $6.50 Taxes yearly. Maps pictures. $2.00 (Refundable). Information Bureau, Norval 3, Ontario, Canada.

CANADIAN LAND FROM $19/ACRE!

CHOICE properties across Canada. Low monthly payments. Ideal for farming, cottages, hunting, fishing, investment. Free catalogue. Canadian Estate Land, Dept. PSC-7, 286 Lawrence Avenue West, Toronto 20, Ontario.

FREE CATALOG! Giant SUMMER Edition! Over 5,100 Properties described, pictured—Land, Farms, Homes, Businesses—Recreation, Retirement. Selected Best thruout the U.S.! 72 Years' Service. Over 600 Offices, 41 States Coast to Coast. Mailed FREE from the World's Largest! STROUT REALTY, INC., 60-BT E. 42nd St., New York, N. Y. 10017; 7-BT S. Dearborn, Chicago, Ill. 60603; 521-BT E. Green, Pasadena, Calif. 91101.

OCALA FOREST CAMPSITES
DEEP in the heart of the Great Ocala National Forest. Excellent hunting and fishing. Free maps and photos. (Unavailable in states requiring separate registration) AD70LB710E, W. H. Vernor, Inc., P. O. Box 760, Dept. Y, Deland, Florida 32720.

BUILD A CABIN ON YOUR OWN LAND in the primitive areas of Montana, Idaho, Washington. You've dreamed of it, now do it on a five to forty acre tract in America's vanishing wilderness. As little as $1550. Low down payment. Terms available at less than bank rates. Guaranteed road access, warranty deed and title insurance. Irreplaceable natural land for enjoyment now, for retirement or investment. Every tract with growing timber. View sites and waterfront available. Draw up your cabin or camper plans and get away from it all on a mountain, stream, lake or deep in the timber. Come and see for yourself or write for free lists of sites, maps and complete information: Reforestation Inc., Dept. C-30, P.O. Box 14006 Opportunity Station, Spokane, Washington 99214.

$1 ACRE — Canadian Border — hundreds campsites, islands, farmlands, directly from tax authorities. (Non-profit) Lists, photographs mailed. Registrar, Room 11, 110 Church Street, Toronto 1, Canada.

FREE Catalog! PHOTOS! Coast to coast farms, business, retirement. All types, sizes, prices. SAFE-BUY Real Estate, Box 589-PS, Little Rock, Arkansas 72203.

GOVERNMENT Lands . . . Low as $1.00 Acre! Vacationing, Homesteading, Investment! Exclusive "U.S. Government Land Buyer's Guide" . . . plus "Land Opportunity Review" listing lands throughout U.S. Send $1.00. Satisfaction Guaranteed! Surplus Lands, Box 19107FG, Washington, D.C. 20036.

32A LOG CABIN & HOME BUILDING

BUILD your own home! Fifty chapter building manual and our most popular plan $5.00. Brochure 25¢. HOME BUILDERS, 136-34 Scott, Dundee, Ill. 60118.

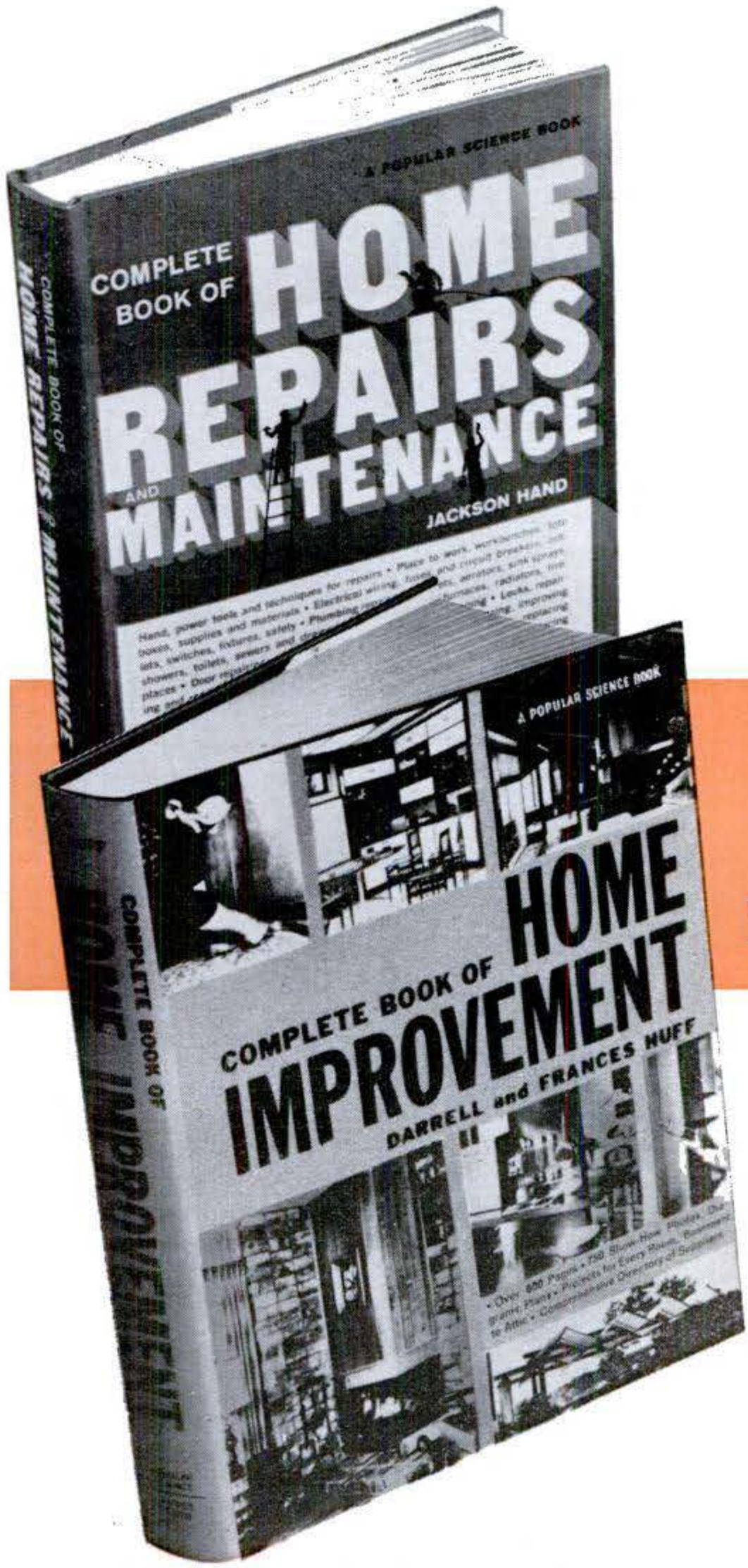
BUILD YOUR OWN
A-FRAME VACATION HOME
SIMPLY. Easily. And save hundreds of dollars. Send $1.00 for our new, colorful brochure that illustrates five great floor plans . . . from a simple retreat to a chalet. Detail drawings, material lists and build-it-yourself instructions available. Alpine Plans, Dept. B, P. O. Box 45012, Cleveland, Ohio 44145.

Copyrighted material

Take this 2-volume, 1,000-page Homeowner's Library,

worth $20.90

free



as your welcome to the
POPULAR SCIENCE BOOK CLUB
And you only need to accept one more regular selection in the coming year!

COMPLETE BOOK OF
HOME IMPROVEMENT
COMPLETE BOOK OF
HOME REPAIRS and MAINTENANCE

COMPLETE BOOK OF HOME IMPROVEMENT is a 628-page idea-and-technique book that gives you the know-how for doing all those home improvement jobs: floors, walls, doors, windows . . . kitchen, bathroom, electrical system, storage areas . . . You can even convert an attic or a basement, add a deck, install a fireplace . . . Instructions are so clear and detailed you can tackle all kinds of things even if you haven't had much experience with tools. 750 illustrations show how-to and provide hundreds of project ideas.

Broken window? Leaky pipes? Squeaky floor boards? Just look it up in your COMPLETE BOOK OF HOME REPAIRS AND MAINTENANCE and the job's already half done. This book provides easy, illustrated step-by-step instructions for making all those home repairs expertly, for working with today's new materials, for modernizing as you repair.

Yes, here are two big, lavishly illustrated books covering every aspect of home improvement, maintenance and repair, a $20.90 value – yours *absolutely free!* It's our way of saying "Welcome to the Popular Science Book Club."

Here's what happens when you join the POPULAR SCIENCE BOOK CLUB

First you get COMPLETE BOOK OF HOME IMPROVEMENT and COMPLETE BOOK OF HOME REPAIR AND MAINTENANCE *free,* and your first regular selection, the three-book Appliance Repair Library, for only $4.85 (regular price of all these books is $31.75!).

Then, every four weeks, you'll receive a Club bulletin fully describing the coming selection which you may either accept or reject. If you want the book do nothing, it will be sent to you automatically. If you don't want the book, you simply return the special form that comes with the bulletin, by the date shown. To retain all membership privileges, you need buy only one book per year, and you may cancel your membership anytime after buying one regular selection.

Popular Science Book Club offers its members only the best books available on auto and home repair, electronics, home workshops and projects, science, space and mathematics. In addition, the country's top experts in their fields create books especially for the Club, books that are unavailable anywhere else at such low prices, books that are invariably the best of their kind.

Each Club selection is offered to members at 35% to 70% off the regular list price. Yet PSBC books are *identical* to publishers' editions.

With every selection you accept, you'll get a free surprise gift – perhaps a compact tool set, magnifying glass, watch band calendar, boot hanger, battery tester or some other equally handy, practical item.

And your first PSBC selection, the three-book paperbound Appliance Repair Library, comes to you at a giant 55% discount!

HOW TO REPAIR MAJOR APPLIANCES
HOW TO REPAIR SMALL APPLIANCES Volume 1
HOW TO REPAIR SMALL APPLIANCES Volume 2

You'll become your own appliance fix-it man –easily–with this three-book personal appliance servicing center. Automatic washer that won't spin . . . fan that vibrates . . . electric clock that won't run . . . Whatever your appliance problem, just look it up and follow the easy, illustrated, step-by-step directions to an expert do-it-yourself repair job. Over 450 photographs, schematic drawings, cutaway and exploded views, and diagrams make it easier than you ever thought it could be.

You get this three-book appliance fix-it library that retails for $10.85 at your PSBC member's price of only $4.85, a 55% savings.

MAIL THE ATTACHED CARD TODAY or write to this address: **POPULAR SCIENCE BOOK CLUB • 44 Hillside Ave., Manhasset, N.Y. 11030**

Copyrighted material

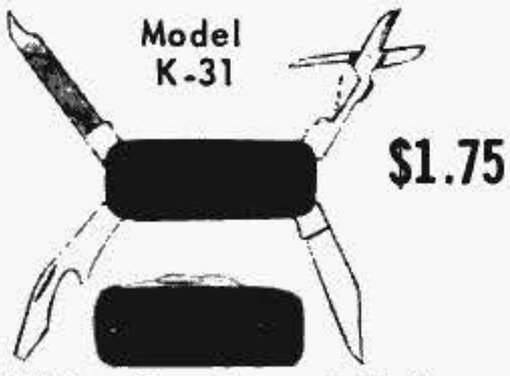
33 SPORTING GOODS, FISHING TACKLE, ETC.

FISHERMEN: Get all the fishing worms you want the lazy man's way. Construct EC's electric worm digger simply, quickly, easily for pennies. Detailed Instructions $1.00. E.C.'s. P.O. Box 15180. Wedgwood Station, Seattle, Washington 98115.

CATCH YOUR LIMIT ANYTIME. Hand Tied Fishing Flies. 25 assorted and tested. $2.95. Redd's, Box 555. Colton, California 92324.

FISHERMAN'S Dream Book—Free. 170 page catalog just loaded with Hard-To-Find Fishing Tackle Specialties and Do-It-Yourself Goodies. Our 28th year. Netcraft Inc., Box 5510. Toledo, Ohio 43613.

FREE 1972 Catalog! Guaranteed lowest prices! Rods. Reels. Lures. Accessories—Thousands of items. Cabela's, Inc., Dept. R7. Sidney, Nebraska 69162.



NEW Leather Covered Knife opens to a sharp scissor that really cuts, a screwdriver, bottle opener, nail file & razor-sharp knife. Wafer thin, slim & ultra smart, this knife is of top quality drop forged steel for durability. Only 2¾" when closed. **$1.75 plus 25c post. & hdlg.**

WESTBURY SALES CO., Dept. K-16-PS
P.O. Box 434, Westbury, N.Y. 11590

34 CAMPING EQUIPMENT & TENTS

FREE catalog. 1400 camping items. I. Goldberg. Dept. J772. 902 Chestnut Street, Philadelphia, Pennsylvania 19107.

LIGHTWEIGHT Equipment for Backpacking. Mountaineering. Camping. Canoeing. Kayaking. Cross-Country Skiing. Free Catalog. Moor & Mountain. Dept. 34. 14 Main Street. Concord. Mass. 01742.

36 HOUSEHOLD PETS

LOOKING for a Special Puppy - Send $1.00 for catalog with prices and information on more han 100 breeds. Hoppe's Kennels. Rt. 21. Hill City. Kansas 67642.

38 BIRDS & ANIMALS

MAKE Big Money raising chinchillas. cavies. rabbits. for us. Catalog 25¢. Keeney Brothers. New Freedom. Pa. 17349.

RAISE Rabbits Successfully by knowing Facts. 48 Page Illustrated Book describing 25 Breeds. Housing. Breeding. Feeding. Markets. Marketing. etc. 25 cents. American Rabbit Association. 60 Arba Building. Pittsburgh. Pa. 15217.

$500-$1000 MONTH Plan Raising Rabbits for us. Free details. White's Rabbitry. Mt. Vernon. Ohio 43050.

$600-UP Monthly. People needed. Raise rabbits. other laboratory animals for us. Huge market. We supply equipment. breeders and instructions. Details 25¢. National Research Farms. PNSA-7. Box 37. Palatine. Illinois 60067.

AMAZING Profits!! $10.000 Yearly Raising Rabbits for Wool and Breeding. Details 25c coin. American Angora. Malta 1. Montana 59538.

39 EARTHWORMS, CRICKETS, FROGS

GROW Fishworms. Outstanding new Breed produces great profits! Free Literature. Fain's Hatchery-27. Edison. Georgia 31746.

HYBRID Redworms — 5.000-$10.00. 20.000-$20.00. Postpaid with raising instructions. Brazos Bait Farms. Rt. 9. Waco. Texas 76705.

FREE Literature—We Teach You To Raise. Sell Fishworms. Crickets. 12-inch African Worms. Carter Farm-12. Plains. Georgia 31780.

EARN Money raising fishworms for us! Exciting details free! Oakhaven-121. Cedar Hill. Texas 75104.

40 HUNTING & FISHING INFORMATION

FREE Catalog Low direct prices. Fishing. Hunting. Archery Reloading. Clothing. Camping Foods. Herter's Inc., Dept. C62. Waseca. Minnesota 56093.

42 FIELD GLASSES, TELESCOPES, MICROSCOPES

TELESCOPES (reflectors) complete kits. Other accessories, request free literature. Criterion Manufacturing. Dept. PS31. Hartford. Connecticut 06101.

DON'T MISS THE ACTION. Sports Glasses. 3X30 power for comfortable viewing. $2.95. Red's. Box 555. Colton. California 92324.

FREE Catalog . . . . Microscopes for students . . . . laboratory . . . . industry . . . . Stereoscopic . . . . photomicrography . . . . Slides . . . . Accessories . . . . Magnifiers . . . . Illuminators . . . . Binoculars . . . . Tools . . . . Ultrasonic Cleaners . . . . Peterzell Company. Box 3658. Rochester. New York 14609.

FREE Catalogue! Thousands war surplus optical bargains. Lenses. Prisms. Telescopes. Binoculars. etc. Jaegers. 691G Merrick Road. Lynbrook. New York.

FREE Binocular. riflescope catalog. Discount sale. Save 50%. Free gift with order. Write: United Binoculars. BN-6716. 9043 So. Western. Chicago 60620.

ASTRONOMICAL Books. Star — Atlases. free list. Herbert Luft. Box 91. Bayside. New York 11364.

43 GOVERNMENT SURPLUS

JEEPS From — $52.50. Typewriters From—$4.15. Cars From—$31.50. Walkie-Talkies. Motorcycles. Airplanes. Boats. Typical "As Is" Bid Bargains From Uncle Sam. Tremendous Variety. Exciting Free List. Write: Enterprises. Box 402-72. Jamaica. New York 11430.

JEEPS! Pickups! 100.000 items direct from government. How? Where? Your area. Latest information. Money back guarantee. Send $2.00 to: Dependable. Manual #2207. Box 113. Vista. California 92083

JEEPS $52.40. Airplanes $75.01. Typewriters $6.70. Boats $7.50. Direct From Government. Directory and Surplus Catalog $1.00 (Refundable). Midwest Surplus. Box 401PS. Dayton. Ohio 45401.

GOVERNMENT Surplus. How and Where to buy in Your Area. Send $1.00. Surplus Information. Headquarters Bldg.. Box 30177PS. Washington. D.C. 20014.

JEEPS Typically From $53.90 . . . . Trucks From $78.40 . . . Boats. Typewriters. Knives. Airplanes. Clothing. Tools. Camping. Sporting. Photographic. Electronics Equipment. Wide Variety. Condition. 100.000 Bid Bargains Direct From Government Nationwide. Complete Sales Directory and Surplus Categories Catalog $1.00 (Deductible On Orders From Separate Included Catalog). Surplus Service. Box 820-B. Holland. Michigan 49423.

1972 SURPLUS Army. Navy store 52 page illustrated catalog. Send 50c. Ruvel. 3037 N. Clark. Dept. 7M. Chicago. Illinois 60614.

45 BODY-BUILDING, SELF-DEFENSE COURSES

KARATE! Complete Illustrated Training. Killing Chart. Card. Certificate. Mail $3.00 To 4M Company. Box 6337. Jacksonville. Florida 32205. Nothing Else To Buy!

KARATE. Judo. Gendo. Tatami 1971 Catalogue. Oldest Dealer 45c. Judo American. B200-1090 Sansome. San Francisco. California 94111.

KARATE—complete instructions. Illustrated only $1.25. Bales Co.. 650-PS. Metcalf. Escondido. California 92025.

"GIANT Arms." Dr. Young's D. C. Revolutionary discovery. $2. Satisfaction or refund. Gaucho. Box 1769S6. Chicago 60690.

"BUILD Muscles Faster!" 24 Concentrated Natural Good Nutrients. 3 months supply $7.00. Satisfaction Guaranteed. Better Health Club. P. O. Box 332PS. Devon. Pennsylvania 19333.

COMPLETE individual courses! Barbells. calisthenics. etc. All $2.95. Consumer Services. 202 St. Lo. Department 1A7. Fort Ord. California 93941.

POWERFUL muscles are yours for the asking. Complete course. $2.95. Guaranteed. SOF. Box 806. Marquette. Michigan 49855.

POWERFUL Muscles Fast!! Obtain fantastic results! Free brochures: Universal Bodybuilding. Dearborn. Michigan 48121.

BEST of Judo—Karate—Self Defense. Complete instructions $1.00. Bargain Books Company. Box 131A5. Auburn. New York 13021.

BE TALLER!

Yes, grow man grow! Gain 2-6 inches actual height in few short weeks! Proven, safe method. Special one time offer: 25¢ coin.

The Height Increase Bureau
P. O. Box 146-PS-13
Brampton, Ontario, Canada

SKINNY GUYS wanted to test fantastic new Muscle-building secret—TENSILE CONTRACTION—by mail. Special one time offer, 25¢ only.

The Bodybuilding Center,
P. O. BOX 146-PS-12
Brampton, Ontario, Canada.

46 PROFITABLE OCCUPATIONS

CASH in on the bicycle boom! Used bikes are spare time profit bonanza! Illustrated booklet gives complete information: how to get bikes. easy shortcuts. $1.00. L. C. Keck. 736 Notre Dame. Concord. California 94518.

BECOME a Mortgage Broker. Highly respected. interesting. lucrative prestige business. For complete information write United. Box 6284-N. Marietta. Ga. 30060.

CLOCK Fixing Simplified. Instructions. Tools. Free Details. Theis. Genoa. Illinois 60135.

FREE catalog. Repair air conditioning refrigeration. Tools. supplies. full instructions. Doolin 2016 Canton. Dallas. Texas 75201.

HOW to Make Money Writing Short Paragraphs. Information Free. Barrett. Dept. C-86-K2. 6216 N. Clark. Chicago. 60660.

FREE Literature—Make Big Money Raising Fishworms and Crickets. Carter Farm-10. Plains. Georgia 31780.

SIMPLEST Small Business Imaginable. Maximum Profit for Minimum Investment of Time and Money. Can be made to run itself. Anyone. Anywhere. Educational. Complete Information $2.50 Westerlo. Gaylordsville. Connecticut 06755.

47 BOOKS & MAGAZINES

USMC "Hand to Hand Combat" Manual. $1.50. Catalog of Manuals. 25c. Hillcrest Publications PS-7. McDonald. Ohio 44437.

FREE List—Hol-Land Books. Box 1025. Bonita Springs. Florida 33923.

BOOK SALE! For FAMILY 20c to 50c. Free brochure. Winchester Enterprises. 2807PS Hargrave Street. Philadelphia. Pennsylvania 19136.

TERRIFIC Book Values! Home Improvement. Science. Crafts. etc. Free Details. Vernco. Box 121B. Whittier. California 90608.

SPECIAL Offer 2 Fantastic books: How To Read Music In one evening. How People Make Money in music. $3.95. Both For $6.90. Guaranteed! Davis Associates. 823 Morrell. Dallas 75203.

FREE Lists. All fields. Name the book or subject. Free search service. No obligation. Information Please. book finders. 1537 Shermer Ave.. Northbrook. Illinois 60062.

SELF improvement library! Crafts. hobbies. sports. etc. Free brochure. Consumer Services. 202 St. Lo. Department 1A7. Fort Ord. California 93941.

CLOCK and Watch Repairing Books. Tools. Materials. Free catalog. North American. Box 77BTA. Fox River Grove. Illinois 60021.

ALL books in print. Hardcover. Paperback. Free information. Sky's Unlimited. 126A3 Deertrack. Irvington. New York 10533.

BE ORGANIZED

IF You save your copies of Popular Science. here's a great way to keep them from getting torn. dirty. etc. Heavy. quality-constructed file boxes hold a year's issues (new. large size format). Gold embossed. Only $4.25 each. postpaid. Order today from Jesse Jones Box Corp.. P. O. Box 5120. Philadelphia. Pa. 19141.

FIX CLOCKS, WATCHES

FOR FUN & PROFIT! Fascinating new Handbook by master craftsman H. Harris gives you the knowledge skilled watchmakers learn. **OVER 200 ILLUSTRATIONS** show how to install hands. dials. crystals. mainsprings. stems—rehouse old movements in modern cases. clean timepieces. etc. **INSTRUCTIONS COVER** every popular watch and clock. chimes. grandfathers. cuckoo. everyday alarm and electric clocks. Handbook tells you where to buy parts . . . where to send "overflow" work for repairs at wholesale prices as business expands! **Friends gladly pay $5 to $50** for restoring cherished timepieces. Try the HANDBOOK OF WATCH AND CLOCK REPAIRS. Rush only $4.95 plus 30¢ handling. on 10-day moneyback guarantee. **EMERSON BOOKS. Inc., Dept. 162-X. 251 West 19 St.. New York. N.Y. 10011.**

49 JOKES & NOVELTIES

FREE World's Leading Catalog 2000 Novelties. Jokes. Tricks. Knives. Guns. Science. Sports Gadgets. Johnson-Smith. C-11. Mt. Clemens. Michigan 48043.

50 MAGIC TRICKS, PUZZLES, ETC.

NEW 1972 large catalog. now ready. Send 10¢ for Catalog showing latest Magic for pocket. parlor. stage. Douglas Magicland. Dept. 12. Dallas. Texas 75201.

COMPLETELY illustrated 84 Page Catalogs. 25c. Manhattan Magic. Box 334-S. N.Y.C. 10011.

1000 WAYS To Have Fun ! ! Giant Houdini Magic Catalog 25¢ with Free Trick ! ! Vick Lawston. Box 2026-PS. Pompano Beach. Florida 33061.

MAGIC. Masks. Novelties Catalog 25c. Magic. 3746 West 63rd Street. Chicago. Illinois 60629.

WORLD'S finest professional magic Joker Novelties. Giant illustrated catalog 10c. Top Hat. Evanston. Ill. 60202.

51 COINS & CURRENCY

SEND only $1.00 for Coin Collecting Outfit. Contains 25 new coins from 25 countries. Plus magnifier. wooden nickel. "How To Collect Coins" booklet. special coin envelopes. foreign banknote and big catalog of coins. paper money. collectors supplies. Littleton Coins. Dept. GH-2. Littleton. New Hampshire 03561.

BRILLIANT Proof Sets: 1961-1962-1963 Each $3.98. 1960-1964 Each $5.49: 1957-1959 Each $5.98. 1971-S $7.49. Lists Other Bargains 18¢. Bebee's Incorp.. Omaha. Nebraska 68111.

15 COINS from 15 countries. $1.00. Robert Getts. 250 Mamaroneck Avenue. White Plains. New York 10605.

LINCOLNS 1909-1958 every year including 1909VDB. 1922D. 50 different (Regularly $12.60). Special $6.95. Harris. Box 2037G. Santa Cruz. Calif. 95060.

FREE Laos Coin With Approvals. Write Lexington Coin Galleries. Dept. PS-7. Box 447. Lexington. Mass. 02173.

UNCIRCULATED Morgan Silver Dollar. $5.00. Catalog 25c. Village Coin Shop. Dept. C. Plaistow. New Hampshire 03865.

COMPLETE U.S. Coin List 25c. Lincoln Starter Sets 50 Different $1.75. 100 Different $3.50. Schultheis. Box 151S. New Hyde Park. New York 11040.

40 MIXED Indianhead and Lincoln cents 1890's to 1930's $2.00. Pavley. Box 518. Cupertino. California 95014.

GOLD COINS of the World. Beautiful. Low Prices. Plus thousands of United States Coins. Free price list. Please send long airmail envelope. self-addressed stamped. Silver Center. Box 22171-S. San Francisco. California 94122.

COLLECTOR'S guides. Coins. Currency. Stamps. 3 160-Page books. Send $2.98. Wilear's Inc.. Dept. 1X. 107 Harrison. Delavan. Wisconsin 53115.

TEN Indianheads $3.50; Ten V-Nickels $3.45; Ten Buffaloes $2.60; Listing 25c. Fairway. Box 685R. White Plains. New York 10602.

U.S. SILVER Half Dollar. Only 75c. Stevens. Box 546A. North Miami. Florida 33161.

UNITED STATES Coins! All types mixed Grab-Bag style. Values $6.00—$60.00. Send $4.00. Coin Surprises, P.O. Box 532, Dearborn, Michigan 48121.

SILVER Dollar $3.10; Silver Certificate $1.95; Large Cent $4.50; Eagle Cent $4.00; Listing 25c. Nelson, 346S, Rye, New York 10580.

PRICE List Of Thousands Of Stamps And Coins. 25c Refundable With Purchase. No Approvals. Bryson, 612P White, Toledo, Ohio 43605.

Sale on scarce dates

Lincoln Cents - 15¢ each
1910 11 13 14 16 17 18
1919S 19D 20S 20D 21 24 25
1925S 26 26D 27 27D 28D 29S
1929D 30S 30D 34D 35S 35D 36S 36D 37S
1937D 38 39S 40S 41S 42D 42S 43 43D
1943S 44S 45S 46S 47S 48S 49S 50S 51S
1952 52S 53D 53S 54 54S 55D 60D
Jefferson Nickels - 25¢ each
1938 39 40 40S 41S 42 42D 42S 43 43S 44
1944D 44S 45 45S 45D 46S 47S 48S 49S 50
1951D 52D 52S 53S 54 54S 55D 56 56D
Roosevelt Dimes - 30¢ each
1946 46D 46S 47 47S 48 48S 49 49D 50
1950S 51 51D 51S 52 52D 52S 53 53D 53S
1954 54D 54S 55S 56D 57D 58 58D 60 60D
Circle dates wanted. Minimum order $1.00. Money back guarantee.

Robert Harris, Dept. AG
Box 2037, Santa Cruz, California 95060
(Established 1946)

52 STAMP COLLECTING

IMPORTANT! PLEASE NOTE!
Most of the stamp advertising below mentions "approvals." This means that in addition to the special offer, you will receive stamps ON APPROVAL from which you may select stamps you wish, and return the balance along with payment for the ones kept. Approvals may continue to be sent unless you indicate you do not wish to purchase any. In some cases the special offer is made only to approval buyers.

FREE! Fine old U.S. Stamps with request for quality U.S. Approvals. Lilbro, Box A, Old Bethpage, N.Y. 11804.

SEND only 10c for the most wonderful catalog of stamp offers in America. You will also receive a special bonus collection of 150 different stamps from St. Vincent, Rwanda, Russia, etc. Littleton Stamps, Dept. MN-2, Littleton, New Hampshire 03561.

FANTASTIC Triangles, Diamonds, 53 others 10c. Approvals. Longhorn Stamps, Lubbock, Texas 79410.

5000 FOREIGN $3.00; 9000 $5.00; 5000 USA, contains airs, presidentials, revenues, 19th century, high values, commemoratives, etc. $3.00; 300 pre-1940 USA commemoratives $2.00; 700 $4.00. No approvals. Meyers, 5321 Fleming, Richmond, California 94804.

KOREA—25 Different 10¢. Approvals. Atlas Stamp Co., Dept. 292, 5485 Edge-Lawn, Grand Rapids, Michigan 49508.

TEN Beautiful Diamonds, Triangles, 10¢. Approvals. McAdams, Box 10902-16, Ferguson, Missouri 63135.

FREE! $10.00 Giant Stamp Collection of 300 All Different colorful, valuable, postage stamps from Africa—Europe—Asia—British Empire—Worth $10.00—$12.00 at catalogue prices. Also money-saving Booklet. All yours as a Get-Acquainted Gift. Adults only. Other fine stamps enclosed for your inspection. Frasek Co., Inc., PS7, White Plains, New York 10601.

100 DIFFERENT, Including Congo Triangles, 30c. Penniston, Box 7253, Arlington, Virginia 22207.

SELL stamps by mailorder to collectors! Earn $1000.00 monthly! Free details. International, 6767PD, South Atlanta, Tulsa 74136.

TRADE Your Duplicates! (Foreign.) New "Free Bonus" Plan! NFK, Box 98S, Newton Highlands, Massachusetts 02161.

SURPRISE Collection! Exotic mint British Colonials absolutely free with approvals. Viking, Great Neck 5, New York 11021.

500 STAMPS Of WESTERN EUROPE —25c—to Approval Applicants. Special Bonus Plan, too! Patrick Stamp Company, P. O. Box 1937, North Hollywood, California 91604.

VATICAN Xmas Set (1967) 50c. Approvals. Barricks, Box 7154, Detroit, Michigan 48202.

500 DIFFERENT worldwide stamps for $1.00. Smith, 508B Brooks, College Station, Texas 77840.

PENNY Approvals! Regardless Catalogue! Kloster 4164—52nd St., San Diego, California 92105.

FREE duplicate exchange—2c approvals. Belden, Box 4175c, Dearborn, Michigan 48126.

77 MYSTERIOUS beauties 10c. Approvals. Stamps, Box 1444S, Kitchener, Ontario, Canada.

100 DIFFERENT United States. 25c. United States and Foreign Approvals included. Shelron, Box 547K, North Miami, Florida 33161.

100 OLD U.S. Stamps between 1861 and 1935 $1.00. Ed Roush, 423 Shepard, Mansfield, Ohio 44907.

FREE Surprise collection sent with approvals. Jay, 1784 Union, San Francisco 94123.

U.S. BARGAIN; 60 different 10c with beautiful world-wide approvals. Stamp Center, Kennebunk, Maine 04043.

SENSATIONAL Clearance Offer. Forty Different Packets Only $1.00. No Approvals. Money back Guarantee. Free Price Lists. Norge, Wyckoff, New Jersey 07481.

COLLECTION Free: Pictorials - Commemoratives. Approvals. Ross, Box 564-PS, Yonkers, New York 10702.

SENSATIONAL Free Offer-20 Outer Space Stamps. Selected Approvals. Louis Morrison, 1027 Maryland, Cape May, New Jersey 08204.

FREE. U.N. Mint Set. Approvals. Hildebrand, Box 5645, Redwood City, California 94063.

NUDES! Ten Different: 20c. Approvals. Stamp Farm, 2S44, Oxford, Wis. 53952.

14,000 DIFFERENT! Amazing new plan builds your collection systematically. Country by Country. Only 50c weekly. Ware, Monroe 70, Connecticut 06468.

RUSSIA 25 pictorials 10c. Approvals. J. Nutt, Box 357, Penn Yan 1, New York 14527.

307 DIFFERENT triangles, sports, topicals, etc. Worth near $8.00 Only 25c. Bargain approvals. Jayto Stamps, Box 177-W, East Syracuse, N.Y. 13057.

"INVERTED Error"—Dag Hammarskjold. 10c with approvals. Belmont Stamps, Washington, D.C. 20015.

FREE! Big Bargain Catalog—New Edition listing thousands of bargains including U.S. & B. N. A. stamps, packets, albums, accessories and supplies. Also, fine stamps from our approval service which you may return without purchases and cancel service at any time. Jamestown Stamp, Dept. E72PS, Jamestown, New York 14701.

50 DIFFERENT U.S. Commemoratives. 25¢. Approvals. We Pay Postage. Craig Stamps, Box 118P, Bellmore, New York 11710.

"AFRICA." 25 beauties, 10c. Approvals. Gorliz, Box 28765CS, Memphis, Tennessee 38128.

WOW! 110 All different Germany 10c. Commemoratives. Airmails. High Values. Big catalog, bargain lists. Also fine stamps from our approval service, which you may return without purchases and cancel service at any time. Jamestown Stamp, Dept. A72PS, Jamestown, New York 14701.

MILLIONS Foreign Stamps 2c each! Send for gigantic approvals! ABC, Box 6000-PS, San Francisco, Calif. 94101.

NUDES set (4)-Unusual Approvals 10c. Atlas, Plainfield, Racine, Wisconsin.

U.S. MINT Specials! Flag Set Complete. $1.00; 1c, 2c, 3c Famous Americans (21 different). $1.00. Free list. Brooks, 2601 Avenue "U", Brooklyn, N.Y. 11229.

50 YEARS Old, fifteen different United States, over fifty years old—10c with approvals. Jaxon, Box 145, Brooklyn, New York 11230.

ABSOLUTELY Free United States Mint Souvenir Sheet When Requesting United States Approvals. K&B, Box 70, Brooklyn, N.Y. 11223.

FAR East Assortment—Viet Nam, Japan, Korea, Formosa and others only 10c with world wide approvals. Clark Stamps, Dept. 58V, Muskegon, Michigan 49444.

ONE Cent a Stamp-write for jumbo books of foreign stamps mounted in Scott order at 1c each stamp. Bullot Philatelics, 6815 Bay Parkway, Brooklyn, New York 11204.

107 BRITISH Colonies. Terrific bargain, 25c. Approvals. Castle, Box 15PS7, Flushing, New York 11352.

400 MIXED U.S. 20c. Approvals. Wright, Box 753P, Hagerstown, Maryland 21740.

100 CANADA 25c. Excellent value. Approvals. Continental, Limehouse, Ontario, Canada.

NEW AFRICAN STAMP COLLECTION INCLUDING Burundi, Guinee, Mali, Rwanda, Togo and others. A colorful addition to your collection, 10c with approvals. Modern Stamps, Dept. 58B, Ferrysburg, Michigan 49409.

225 STAMPS FOR ONLY 10c! Airmails, Pictorials; stamps from strange countries cataloguing up to 25c each! Plus unusual stamps to examine. Buy any or none, return balance, cancel service anytime. MYSTIC STAMP CO., Camden 55, New York 13316.

80 DIFFERENT U.S. Stamps. Includes 1943 Flag Stamp of occupied Nations. Only 25c. Approvals included. Willett Co., Box 338-Y, Yorktown Heights, New York 10598.

FREE Rare U.S. 19th Century Stamps with Fine Approvals. Historic Stamps, Box 427, College Point, N.Y. 11356.

WORLD wide stamps 2c each! Write for exceptional approvals. Pan Pacific, Box 1895G, Studio City, California 91604.

54 RADIO, TELEVISION, HAM EQUIPMENT

36c TUBES. Radio & TV! Free Color Catalog. Cornell, 4217S, University, San Diego, California 92105.

FREE Brochure Radio Converters For Fire, Police. Write: S.A.C., Box 276, South Glastonbury, Connecticut 06073.

GOVERNMENT surplus electronics, gadgeteers illustrated catalog 25c. Meshna, Nahant, Massachusetts 01908.

LINEAR AMPLIFIERS: 10 Meters. "Hawk" - 25 watts - $59.95; "Raider" - 100 watts - $149.95; "Maverick-250" - 250 watts - $244.95. AM/SSB, 12 volt mobile amplifiers - "Scorpion" - 50 watts - $99.95; "Bandit II" - 100 watts - $169.95; new "Falcon-400" - 400 watts -$314.95. 20-35 megacycles. (Illegal Class D II meters.) Dealer inquiries invited. D&A Manufacturing Company, 1217 Avenue C, Scottsbluff, Neb. 69361.

55 HI-FI, STEREO, ELECTRONICS

WHOLESALE Prices. Cartridges, Diamond Needles, Turntables, Blank Tape, Pickering, Shure, Garrard, Dual, Scotch, others. Buy ones, dozens. PS Distributers, 32 Copeland, Quincy, Massachusetts 02169.

FREE Catalog—Electronic kits—amplifiers—preamplifiers—psychedelic strobes —SCA Adaptors—color organs—digital instruments — guitar amplifiers. Free Subscription, SWTPC, Box PS32040, San Antonio, Texas 78284.

CONVERT your stereo to synthesized four-channel stereo. No need for second amplifier! Beautiful reproduction of four-channel stereo, excellent sound quality! Gives same effect as systems costing hundreds more. Includes earphone jack, instructions. Not a kit. Complete, ready for use. Only $9.98. Quadra-Sound, P.O. Box 142, Putnam, Connecticut 06260.

SLEEP-LEARNING KITS — endless tapes, timers, complete outfits. Catalog free. SLRA, Box 24-SB, Olympia, Washington.

56 PHONOGRAPH RECORDS, TAPES

EIGHT tracks, cassettes, lowest prices. Catalog free. Tietje, Box 30161, New Orleans, Louisiana.

REMEMBER Radio?? Catalog 50c—TBOR, Box 1692F, F.D.R. Station, New York 10022.

SCRATCHED records? Fix them. Stop skipping with RiCon. $5.85. RiCon, Danielson, Connecticut 06239.

GOLDEN Age Radio. Complete taped shows. Box 8404P, St. Louis, Mo. 63132.

OLDIES - 45 RPM Original Hits - Catalog 50c. C&S Record Sales, Box 197, Wampsville, New York 13163.

FREE Monthly Tape and Record Bargain List. Roseman, Box 16083, Philadelphia, Pa. 19114.

VINTAGE radio programs. 176 page catalog—$1.00. Stop, Box 3402, Seminole, Florida 33542.

FREE Catalogues. 2000 hard to find unusual records. Rose's, 128 Breckinridge, Louisville, Kentucky 40207.

PHONOGRAPH Needles $3.00. Cartridges. Save ½. Phonoco, 2008 Avenue C, Council Bluffs, Iowa 51501.

57 MUSICAL INSTRUMENTS

GUITAR MAKING Books. Imported Woods. Supplies. Accessories. Catalog 25¢. Guitar Center, Box 15444, Tulsa, Oklahoma 74115.

ELECTRIFY Player Pianos, Pump Organs quickly, inexpensively with Lee Silent Suction units. Write Lee Music, 525A Venezia Ave., Venice, California 90291.

WHOLESALE Professional Guitars, Amplifiers, PA Systems. Free Catalog. Carvin, Escondido, California 92026.

REBUILD A Player Piano! Details from Vestal Press, Vestal 8, N.Y. 13850.

ACCORDIONS And Amplifiers! New - Used. Cordovox, Excelsior - Top Makes! Save to 50%. Direct factory dealer. Terms. Trades accepted. 5 day home trial. Free catalog - Discount prices. Write: Accordions Unlimited, Dept. P, 3147 North Luna, Chicago 60641.

30% DISCOUNT. Name Brand Musical Instruments. Free Catalog. Freeport Music, 455C, Route 10, Melville, N.Y. 11746.

LEARN Banjo-5-string Bluegrass. No music. Makes learning easy. Free details. Blaylock, Box 25-D, Marietta, Georgia 30060.

VIOLIN and Guitar makers—send for latest Free Catalogue of woods — accessories. International Violin PS1, 414 East Baltimore St., Baltimore, Md. 21202.

WHOLESALE. Musical Instruments, Accessories. Allied, 573 Route 17, Paramus, New Jersey 07652.

58 SONG WRITERS

POEMS and Lyrics of religious, reverent, inspired nature wanted for immediate recording. We are only interested in songs of hope, God's love, the comfort of His words and wisdom. Cathedral Recording, P.O. Box 78PS, North Weymouth, Massachusetts 02191.

SONGS, Poems Wanted! Accepted songs published, recorded at our expense! Talent 17-PS Longwood Road, Quincy, Massachusetts 02169.

POEMS accepted for new songs recorded without charge. Songs/poems examined free. Tin Pan Alley, Box 11647-PA, Sarasota, Florida 33578.

SONGWRITERS. Subscription three dollars. Song Request Magazine, Mount Morris, Michigan 48458.

POEMS wanted for songs. Nashville Music Productions, Box 40001-M, Nashville, Tennessee 37204.

SONGPOEMS Urgently Needed. Possible Recording/Publishing, 50-50 Agreement. Betty's Music Makers, 1417P Park Building, Pittsburgh, Pa. 15222.

POEMS set to music. Songs recorded. Send poems, songs. Crown Music, 49-P West 32, New York 10001.

59 IMPORT - EXPORT

ORIGINAL Oil Paintings 16x20" $72 Dozen. Max McDaniel, Claymont, Delaware 19704.

60 BUSINESS OPPORTUNITIES

SECRET Loans. Get $500 . . . $35,000 . . . Up to $2 million easily. Free details. Capital-3, Kerrville, Texas 78028.

FREE Millionaire Book . . . A Fortune in successful little businesses. Work home! SBI-3, Kerrville, Texas 78028.

FREE CATALOG
THOUSAND Items. Guaranteed Lowest Wholesale Prices. Your Own Business. No Investment. Earn Highest Profits With An Established, Reliable Company. Since 1950. Free Details. Write Western-Pacific Imports, 4069-30th Street, San Diego, California 92104.

BOOKKEEPING SYSTEM—Substantial Income! Start Tax Service. KERN, Box 263, North Hollywood, Calif. 91603.

PREPARE Tax Returns — Policeman Albert Myers made $2,000 his very first season. Train at Home. VA Approved. National Tax School, Monsey, 1AD, New York 10952.

BECOME "Mortgage Broker." Lucrative! Capital Sources, Box 99-B, Uleta, Florida 33164.

SELL Books by Mail. Complete Dealer Set-up - 20c. Midwest Mail Sales, Box 44R2, Shawano, Wisconsin 54166.

VENDING Machine. No selling. Routes earn amazing profits. Big catalogue Free. Parkway Corporation, 715PSB Ensor Street, Baltimore, Md. 21202.

$10,000 YEARLY—selling books by mail. Details 25c. Royal-12L7, 277 Vancortland Ave., Bronx, New York 10467.

Copyrighted material

100 NEW Stereo 8 Track Tape Cartridges $150.00. 10 Different $19.00. State Favorite Music And Artists. Free Lists. Sound Sales. Box 14. West Union. Iowa 52175.

$2.000 MONTHLY in Amazing Businesses. Details. Walker-PS. 5302 First Street Northwest. Washington. D.C. 20011.

BUSINESS Loans. Commercial. Residential. Industrial. William. 28 East Jackson Blvd.. Suite 1204. Chicago. Illinois 60604.

MAILORDER SECRETS REVEALED! Start Home Business. High Profits. Little Capital. No Inventory. Free Details. Write Emery. Box 366PS. St. Ann. Missouri 63074.

FREE Collection Agency Details. $1000.00 Monthly Possible. Master 1. Drawer 77009. Atlanta. Georgia 30309.

PUBLISH Chronicle Magazine. Particulars with Chronicle 50c. Richard McPlastens. PS1432 First. San Diego. California 92101.

HOW To Raise $100.00 To $1.000.-000.00!! Valuable Details Free. Drawer 77009-PS. Atlanta. Georgia 30309.

MAKE money at home. Proven best way. Free details. Janis. Dept. A. 17686 Beland. Detroit. Michigan 48234.

MAILORDER—carry no stock. Companies will pack. ship under your label. One-man operation capable of $10.000-$20.000 year. Details Free! Distributors. Box 9B. East Rockaway. N.Y. 11518.

COMPLETE Mail Order Business For Sale. Free Details. AM Sales. 3228 100 Street. East Elmhurst. New York 11369.

MORTGAGE Brokers earn big commissions. Let us tell you how. Write for free information. United. Box 6284-O. Marietta. Georgia 30060.

MONEYMAKING is an Art! Free Information. House of Hoke. Dept. 101-PS. Sebring. Florida 33870.

$200.00 SPARE Time earnings with your Tablesaw. Write: Workshop Four. 3800 Harney. Vancouver. Wash. 98660.

MAKE Year's Income in 8 weeks Camping. No selling. Capital or Land necessary. Write Edru's. Route 5. Box 5733. Gig Harbor. Washington 98335.

BOOKKEEPERS earn $500.00 week. Operate Bookkeeping Tax Service. Details free. Universal Bookkeeping. Box 664-P. Springfield. Missouri 12110.

MAKE Magnetic signs. Machineless method. Profits enormous. Write R1B49APS. Bardstown. Kentucky 40004.

CLIP Newspaper items. To $10.00 each. Details free. Foster. 272-P7. Brooklyn 11235.

$70 TO $200 Weekly-Home. Spare Time Simplified Mail Bookkeeping. Immediate Income. Easy. Auditax. Box 34741D. Los Angeles. California 90034.

STUFF Envelopes. Make 25c each. No addressing or Postage necessary. Details $1.00. Davan. Box 7T. Middle Island. New York 11953.

MAIL Baby catalogs. imprint. to new mothers. Big profits! Details $1.00. Kriefski. 609-B Lee. Plymouth. Pennsylvania 18651.

AVOID Get-Rich-Quick Schemes! Try Delta's Mailorder Method for Safe. Steady Results! Delta. Box 19281-O. New Orleans. Louisiana 70179.

VACUUM Sign Machine 24"x24". $175.00. Homecraft. 2350 W47. Denver. Colorado 80211.

ADDRESSERS And Mailers Needed. Details 10c. Lindbloom Sales. 3636 Peterson. Chicago. Illinois 60859.

HOLLYWOOD Cementcraft: Offers Highly Profitable Home Business. Experience unnecessary. Unlimited Unique Pottery Designs. Easily Made Without Moulds. Bird-baths. Fountains. Wishing Wells. Waterfalls. etc. Chemical Coloring Formula Marble-glazing. Free illustrated Brochure. Concrete Facts. 602 Athens Street. Altadena. Calif.. 91001.

MAKE $46 From Square Foot Plywood; Jigsaw or Bandsaw necessary. Free Details. Wooderd Bridgewater. Massachusetts 02324.

$60.00 DAY. Manufacturing concrete posts. Blocks. Mold Equipment Catalog $1.00 refundable. Carlane. Route One. Box 95. Rapid City. South Dakota 57701.

EARN $1000 Monthly with Mail Order Collection agency. Continental. Box 2023B. Des Moines. Iowa 50310.

MONEY! It's Waiting For you in Mailorder. $500 Weekly Easy. Free Information. The Partridge Family. 217 Old Neck Road. Center Moriches. New York 11934.

MAILORDER Millionaire helps beginners make $500 weekly. Free report reveals secret plan! Executive (1B7). 333 North Michigan. Chicago 60601.

FREE REPORT: "609 Unusually successful businesses." Work home. Nichols. 5839 Syracuse. Taylor. Michigan 48180.

WORLD'S Biggest Wholesale Supply. Buy from 10.001 U.S.A. European. Japanese and Hong Kong Wholesalers. Many below wholesale! Have your own imprinted Catalogs. Free Details. Bargainhunters Opportunities. Box 730-B. Holland. Michigan 49423.

$200.00 DAILY in Your Mailbox! Your Opportunity to Do What Mailorder Experts Do. Free Details. Associates. Box 136-B. Holland. Michigan 49423.

TREMENDOUS Wholesale Bargains. Half million nationally known products. Rock-bottom prices. Closeouts. bankrupts. Dropship merchandise. Automobiles. Worldwide Imports. Hongkong clothes. Free details. International Buyers. Box 16386-PS5. Portland. Ore. 97233.

FREE Literature—Make Big Money Raising Fishworms and Crickets. Carter Farm. Plains. Georgia 31780.

BUILD Custom Cases at home for profit. Get orders by mail. We supply materials. instruction—everything. Free Home Business Details. CSCC. 6075 CSQ. De Soto Avenue. Woodland Hills. California 91364.

PORTABLE Sandblaster $21.00 (air-compressor required). Free brochure. Inka. Box 66573C. Houston. Texas 77006.

1100% PROFIT At Home Metalizing Baby Shoes. Novelties. Bronze. gold. silver. pearl. Free Proof! Kiktavi. Box 2127B. Inglewood. California 90305.

PIANO Tuning Learned quickly at home! Tremendous field! Musical knowledge unnecessary. GI Approved. Information free. Empire School. Box 327. Miami. Florida 33145.

EARN $60.00 Daily Manufacturing Concrete Fence Posts. Practically no investment. Send Stamped-addressed envelope. American. Excelsior Springs. Missouri 64024.

GUARANTEED $25.000 1st year mail order earnings. Free Details. Glenwood. 4721B Indiana. Salem. Oregon 97303.

ADDRESSERS And Mailers Needed. Details 10c. Slack's. Box 375. Toronto 19. Ontario.

INCOME opportunity as LPI Associate. Free information. catalog 30c. Write now. LPI. 11611 Sharpcrest. Houston 77072.

I MADE $100 An Hour Selling Information By Mail. You Can Too! Ropchan. Box 5341S. Sherman Oaks. California 91413.

HOW and where to get capital. $5000+ possible in one day. Free details. James Peter. Box 571E. Westwood. New Jersey 07675.

MAIL order specialist reveals how to start mail order business: product selection. sources. pricing. publicity. use of publications. direct mail. catalogs. lists. Discusses seasonal factors. tricks of trade. Fascinating 54-page Manual only $1. Mail Order Institute. Dept. A. 83-21 247th St.. Bellerose. New York 11426.

FREE Book "How To Fail or Succeed in mailorder!" Plymouth. MMFG. Box 111. Brooklyn. New York 11223.

MAILORDER Dealers Wanted. Earn outstanding profits using tested promotions! Executive type business. Details 25c. Rutward. Box 735-WJ. Norwalk. Connecticut 06852.

SELL Books!! Complete Mailorder Plan. Vikari's. Box 1312PS2. Salt Lake City. Utah 84110.

900% PROFIT For Men And Women with your own Magnetic Sign Shop! Big demand for 3-D magnetic signs on cars and trucks. Start in garage. kitchen or camper. Spare or full time. Financing available. Write today for free details. Nationwide Plastics. Dept. 262. 4200 Panamint. Los Angeles. California 90065.

SECRETS! Mail Order Success. Internationally famous expert reveals how to make home business fortunes. Beginners: Get free copy "Make Money By Mail." Discloses free advertising. profitable products. Mailco. Dept. FC697. Woodland Hills. California 91364.

FREE Book "999 Successful. Little-Known Businesses." Work home! Plymouth-AFH. Brooklyn. New York 11218.

MAILORDER Moneymaking Kit. Home Business. Valuable lists. concrete information. detailed steps. Capital unnecessary. Free Details. Pictures. Meadows. Box 327PS7. Boston 02199.

MAILORDER: How to prepare your own catalog for pennies! Free Catalog! Obie-AFG. Brooklyn. New York 11219.

$100.00 WEEKLY spare room. Raise redworms Odorless Soilless way. Charles Morgan. Box 116-C. Bushnell. Fla. 33513.

INSTALL Burglar alarms without previous experience or costly equipment. Big profit. Free details. Nasco. Dept. F2697. Woodland Hills. California 91364.

CLIP Newspaper items $1.00-$5.00 each. Details free. Walter. Box 1360-SA. Erie. Pennsylvania.

IMPORT-Export opportunity. profitable world-wide mailorder business from home. without capital; or travel abroad. We ship plan for no risk examination. Experience unnecessary. Free details. Mellinger. Dept. F2697. Woodland Hills. California 91364.

EXTRA Money! Sell Personalized Metal Social Security Plates. Sales Kit Free! Myers. 928PS Crescenthill. Nashville. Tennessee 37206.

EARN Money raising fishworms for us. Write: Oakhaven-43. Cedar Hill. Texas 75104.

I MADE $40.000.00 Year by Mailorder! Helped others make money! Start with $10.00—Free Proof! Torrey. Box 318F. Ypsilanti. Michigan 48197.

MAIL Baby Catalogs imprinted with your address to New Mothers for Big Profits! Details 25c. Volz-PS. Ypsilanti. Michigan 48197.

MEN-Women Make Big Profits At Home! In plastics. part or full time! Unique process teaches you with equipment we give you free to make hundreds of 3-D plastic products. candy and candle molds. plaques. signs. Skin and bubble package. Also resin casting. Write today for free details. Nationwide Plastics. Dept. ASC. 4140 Eagle Rock Blvd.. Los Angeles. California 90065.

GUARANTEED $25.000 First Year Mail Order earnings. Details 25c. Wade. 347P Plaza. Louisville. Kentucky 40218.

VENDING Machine Catalog. Rake. 523 PS Spring Garden. Phila.. Pa. 19123.

MAKE 2 to 3 times your cost wholesaling 1001 products. Gifts. Mail Order Specialties. Toys. Novelties. Carded Merchandise . . . Guaranteed lowest below wholesale prices. Free home business details. SMC. 6061-SSY DeSoto Avenue. Woodland Hills. Calif. 91364.

DRAFTSMEN! Operate Own DRAFTING SERVICE: Full. Part Time; Experience Unnecessary; Free Details; Roberts Company. 1741 Circle Road. Baltimore. Maryland 21204.

YOUR Own Social Security Plate Business—$24.95! (Machine included.) Free Details. Idea Products. Box 69828XG. Los Angeles 90069.

$1000 DAY—150% profit. Selling by mail. No investment in inventory. Part time—full time. Unlimited potential. Complete details $1.00. National. Box 7212ZAH. Chicago. Illinois 60680.

START Your Own Correspondence School—United Career Schools. 5820 Imperial. South Gate. California 90280.

GUARANTEED INCOME! Home Mailorder Business can make you rich! Everything furnished—even national advertising. Details $1.00. Galaxy (2Q7). 15307 Nevada Street. Woodbridge. Virginia 22191.

YOUR MAILORDER BUSINESS is already established! "Your Complete Mailorder Guide" and sample Catalog prove it. Rush $5.00 now. Galaxy (5Q7). 15307 Nevada Street. Woodbridge. Virginia 22191.

BIG Profits Raising Worms. Garage. Basement. Soilless Method. Three Oaks. Dresden. Tennessee 38225.

CALIFORNIA MANUFACTURER NEEDS MAN to assemble our product and be local agent. experience unnecessary. May start while presently employed. Five-figure income for responsible applicant. S.K.R.C. Manufacturers. 2347 West 238th Street. Torrance. California 90501.

61 MONEYMAKING OPPORTUNITIES

BUY BELOW WHOLESALE! Thousands of name-brand items at factory prices plus small service charge! Directly thru us. Free details! American Buyer's. P.O. Box 848S. Buffalo. N.Y. 14240.

PENNY STOCKS have profit potential. Free information. Analyst-PS. Box 214. Redondo Beach. Calif. 90277.

EASY-to-start rubber stamp business at home in spare time. Make up to $16.50 an hour without experience. Facts free! Write to: Roberts. Room RC-3-BK. 1512 Jarvis. Chicago. Illinois 60626.

$100.00 WEEKLY Possible Mailing for Firms. Information 25c (Refundable) and self-addressed. Stamped envelope! Robison Ta. P.O. Box 788. Shawnee. Oklahoma 74801.

"PAY"—Home Mailer's New Moneymaking Opportunity. Rush stamped envelope. Starkey. 1142 Antioch Rd.. Nashville. Tennessee 37211.

MEN—Women Needed to fill out income tax forms at home. We show you how. Simple. easy to learn. $700 per month earnings possible. Details mailed free. No Salesmen. Hurry! Federated Tax Service. 2020 Montrose. Chicago 60618.

HIGHER INCOME. Security and Power. 256 page Book "Thinking Big" reveals secrets that make men Rich! Send $2.00 to Dept. 10. House of Gifts. 11306 Jeff-Davis Hwy.. Richmond. Va. 23234.

TREMENDOUS earning potential. Three unique businesses operated from home. Jeboco. Box 6542SG. Surfside. Florida 33154.

$125.00 WEEKLY correcting pupils' lessons! Samples. $1.00! Gulley. Humphrey. Arkansas 72073. Rella. 1381 Castle Hill. Bronx 10462. Borden. R1. =27. Lawrence 49064. Quinten. 101 Vermont. Travis 94535.

SUCCESS METHOD: Make $1.000.000 —10 years. Start with $10. Free proof. Opportunities. Box 721B. Lynbrook. New York 11563.

FREE Yourself Financially—Millionaire in 30 Days Plan. Fantastic Method! Send $1.00 to Paslow Company. 15 Clifton Blvd.. Pittsburgh. Pa. 15210.

BE SUCCESSFUL In Home Service Field! Free Details. Tri-tech. 3911A McKeith. Midland. Michigan 48640.

CLIP newspaper items. To $10.00 each. Details free. Foster. 272-PC7. Brooklyn 11235.

LEARN the secrets of repairing junk batteries. "Fabulous Profits" at home. Battery Shop. Box 820. La Quinta. California 92253.

$200.00 FROM sheet ¼" Plywood (Scrap) Details 25c. Novelties. 610 So. 24th. Elwood. Indiana 46036.

FREE catalog 101 Mailorder specialties and gifts. Buy below wholesale. B&M. Glenoma. Washington 98336.

$1.00 LIST you with 1000 Importers. Jobbers more mailings year. Dixmail. King. North Carolina 27021.

RAISE Chinchillas. Guaranteed income. Catalog $1.00. DeShon Chinchilla. Route Two. Roanoke. Indiana 46783.

MAKE $1.00 Per Sale selling engraved metal Social Security plates. Free Sales Kit. Engravaplates. Box 10460-55. Jacksonville. Florida 32207.

HOW to Make Money Writing Short Paragraphs. Information Free. Barrett. Dept. C-36-K1. 6216 N. Clark. Chicago. 60660.

101 COMPANIES offering home employment! Names. addresses. types of employment offered plus application forms. yours for $1.00. Jobguide. 69-29S Queens Blvd.. Woodside. N.Y. 11377.

BIG money writing Jokes. Enormous demand. We show you how. Free Facts. Laffs. Dept. G197. Pleasant Hill. Ohio 45359.

WE NEED AKC PUPPIES!
BUY puppies for us in your area. Make $50 to $250 per week. No cash or experience necessary. Write for free details. AKC Dogs. Box 211. Orchard Lake. Michigan 48033.

200% PROFIT Selling Rings. Triple Money In 30 Days Or Money Back. Free Details. Anka. P.O. Box 8036-PS. Cranston. Rhode Island 02920.

WORLD'S leading contest magazine. 25c. Year—$4.00. Prizewinner. 1315 Central. St. Petersburg. Florida 33705.

SELL Sensational Car Thief Signal. Lightning Seller. Samples for trial. Northwest Electric. Ave. 857. Mitchell. South Dakota 57301.

FREE 1972 100-page Catalog waiting to bring you Big spare-time cash commissions. Sell Advertising Book Matches. Every business a prospect . . . complete selling instructions furnished. Steady repeat business. Dept. PA-772. Superior Match Company. 7530 South Greenwood. Chicago. Illinois 60619.

FREE. Learn dozens of easy ways to make money full or part time. Write for Free 5-month subscription. Salesman's Opportunity Magazine. Dept. 18-GM. 1460 Hancock Center. Chicago 60611.

$600 UP Monthly. People needed. Raise rabbits. other laboratory animals for us. Huge market. We supply equipment. breeders and instructions. Details 25c. National Research Farms. PNS-7. Box 37. Palatine. Illinois 60067.

MAILERS Wanted! Gross up to $500.00. mailing 1000 circulars. Details. 25c. Smyre's. 953PS. Newark. N.J. 07101.

1000% PROFIT Bronzing Shoes. Free Literature. Box C-4-PS. Coral Springs. Florida 33065.

Copyrighted material

SHARP $$$ opportunity! One low-cost machine sharpens, serrates, knives, scissors, pinking shears. Earn $6-$9 hourly in spare time. Professional results without experience. Free details. Beaver Grinder, 7S2, Nielson Building, Eugene, Oregon 97402.

FINDERHOOD®

Founded in 1961, this world-wide finders' club releases bi-monthly Reports on finder's fee opportunities in business, investments, and allied fields. Listings are backed by signed payment agreements. 3-year membership: $100. (Foreign, $125). Trial membership: $2.

FINDERHOOD, INC.
15 W. 38 St., (SC-33), N.Y., N.Y. 10018

62 EMPLOYMENT INFORMATION

OVERSEAS Job Placement Directory. 32 Pages Current Worldwide Openings. Moneyback Guarantee. $3.00. Overseas, Box 29902B, Los Angeles 90029.

AUSTRALIA . . . FREE DETAILS! Exciting Employment Opportunities! Government Paid Transportation! Also information about Housing, Education, Teaching, Business, Land, Farming! Australian Services, Box 29263FG, Indianapolis, Indiana 46229.

HOME Addressers Needed. Details 16c Stamps. Wadsworth House, 221 Yorkshire Drive, Spartanburg, South Carolina 29301.

AUSTRALIA WANTS YOU!!! Government Assisted Passage. 1972 Government Information and Forms—Most Complete Information Available—$1.00. Reports on Employment, Business, Taxes, Education, Teaching, Housing, Ranching, Maps, etc.: AUSTCO, Box 3623F, Long Beach, California 90803.

"FACTS ABOUT AUSTRALIA" (48 page 1971 edition) wages, prices, taxes, housing, education, etc. $2.00—"ESTABLISHING A BUSINESS IN AUSTRALIA" (66 page 1972 edition) $2.00—"AUSTRALIA HANDBOOK 1972" (280 pages) $3.00—"ILLUSTRATED ATLAS OF AUSTRALIA" (16 pages, 1972 edition) $2.00—Classified "POSITIONS VACANT" $2.00. Or all for $6.00. Former Californian, Write—T.R.M. Spence, P. O. Box 413, Manly, N.S.W. 2095, Australia.

AUSTRALIA!! FREE DETAILS!! Jobs Galore. Government Paid Transportation. Write: Associated, Box 17-C128, Lafayette, California 94549.

WORLD-WIDE . . . U.S.A. Jobs Galore! ! ! Students, all professions and occupations. Enjoy Paris, Rome, Tokyo, Mexico City, Miami, San Francisco. $700.00 to $3,000.00 monthly. Paid Overtime. Travel Allowance. Sightseeing. Free Details! ! Write: Global Employment, Box 706-C128, Orinda, Calif. 94563.

OVERSEAS EMPLOYMENT . . . Australia, Europe, South America, Asia! All occupations! $700-$3,000 monthly! Write: Employment International, Box 29217-FG, Indianapolis, Indiana 46229.

AIRLINE flight jobs—fly as pursers, stewards, stewardesses. Well paid travel, major airlines. Detailed information; interviews, requirements, etc. $3.00. Airline Job Facts, Box 716, Fairfield, Connecticut 06430.

AUSTRALIA Needs You! Government Assisted Transportation. Latest Handbook And Forms. $1.00. Carpenters Advertising Agency, POB416PS, Col. Heights, Virginia 23834.

OVERSEAS Jobs Directory—Now Hiring—High Pay, Adventure. $1.00. Transworld, Box 90802F, International Airport, Los Angeles, California 90009.

63 SPECIAL SERVICES

CHEMIST FOR HIRE by the job. Trouble shooting, formulas consultation, research. Free estimates. Kenneth Burchette, Box 1114, Spring Valley, California 92077.

FREE. 100 names, all mail buyers! Free bonus certificate worth $1.00 in trade. Send 25c postage and handling. Royal Sale, 210 Fifth Avenue, New York, New York 10010.

INFORMATION On Anything. Ferguson Research Specialists, 83-45 Vietor Ave., Elmhurst, New York 11373.

66 AGENTS WANTED

NEED More Money? Represent largest manufacturer of magnetic signs for business vehicles. Write TRIMETRIC, 337 El Roblar, Ojai, California 93023.

WANT TO MAKE UP TO $100 A WEEK spare time and get free shoes for life, too? No investment. Rush card for free details. Mason Shoes, K-912, Chippewa Falls, Wisconsin 54729.

EVERY man a prospect. Refundable sales kit offer showing line belt buckles, tie clasps, money clips, cuff links, lapels, identification badges, individualized with customer's name and emblems. Cap badges for trucking, bus, taxi, police, firemen, also postal, letter carriers and heavy construction emblems. Choice 4000 emblems. Hookfast, Box 1088-PS, Providence, R.I. 02901.

LIFETIME Income. Be our loan representative. Free Copy "Financial Freedom." Send $1.00 refundable. Financial, Suite 1204X2, 28 E. Jackson, Chicago 60604.

SELL Office Supplies—Machines—Furniture—Equipment. Oseco, 3505PS Elston, Chicago 60618.

YOUR own business—Suits $1.50; Overcoats 65c; Mackinaws 35c; Shoes 12½c; Ladies' Coats 30c; Dresses 15c. Enormous profits. Catalog Free. Nathan Portnoy Assoc., 2109-J, Roosevelt Road, Chicago, Illinois 60608.

67 SALESMEN—DISTRIBUTORS WANTED

SELL Advertising Ball Pens, Calendars, Ad-Specialties—Build Own Repeat Business—Free Details—Fleming, Dept. B, 6535 Cottage Grove, Chicago 60637.

HOT!!! Tool Costs 40¢ Sells $2.00. Sample—$1.50 (.50¢ Postage). Speedline, Box 458, Woodriver, Illinois 62095.

SELL HERTEL BIBLES—Part Time. Finest reference Bible available. Demonstrator and supplies furnished. Excellent commissions. Write International Book, Dept. P, Box 118, Wichita, Kansas 67201.

LONG Needed Invention. Want man contact service stations. Part Time. Huge profits. Write Cyclo, 3816 Dahlia, Dept. 171, Denver, Colorado 80207.

BIG steady income! Leader in business printing/advertising specialties will start you in business. No experience. No stock investment. Full, part time. Everything furnished. Write Kaeser, Dept. B1017, 953 Martin Place, Cincinnati, Ohio 45202.

MAKE Extra $25 to $75 spare time! Double air cushion shoes. Men's, Women's line. Dress, work, play. Highest commissions. Shoes for yourself. Outfit free! Bronson, Dept. W-72, Minneapolis, Minnesota 55408.

FREE—Easy Ways to make money selling exciting new products—full - spare time. Send name, age for 5 months free subscription. Salesman's Opportunity Magazine, 1460 Hancock Center, Dept. 18-GS, Chicago, Illinois 80611.

EARN Big Commission Full or Part Time. Show America's largest line Low Priced Business Printing and Advertising Specialties Plus calendars in season. No experience. No investment. No collections or deliveries. On-the-spot commissions. Big Free Sales Kit samples hundred items used daily by businessmen. Merchandise bonuses for you. Build profitable repeat business. Start now. National Press, Dept. 72E, Waukegan, Illinois 60085.

68 REMAILING SERVICES

HAWAII Mail Service. Singles 25c. Monthly rates. Member International Remail-Forwarding Association. Flink, Box 1536C, Hilo, Hawaii 96720.

OTTAWA, Canada Remails, 25c each, details Free. Box 3792-C, Ottawa, Canada K1Y OE7.

PALO ALTO—Stanford. Single 25¢ monthly $3.00. Box 1312, Cupertino, California 95014.

WASHINGTON, DC Remails 25c. Receiving-Forwarding. Gabriel, Box 4552S, Washington, D.C. 20017.

DALLAS Remails 25c. Economical. Receiving-Forwarding. Nortex, Box 875, Weatherford, Texas 76086.

RECEIVING - Forwarding. Monthly rates. Hedgpeth, 324PS South First, Alhambra, California 91802.

REMAILS 25c. Playground of the World Atlantic City, Atlantic City, New Jersey, Box 632, Millville, N. J. 08332.

TOKYO $1.00. HONOLULU 50c. SEATTLE 25c. Picture post cards 5/$1.00. Prompt, confidential. Polaris, Box 98355-P, Seattle, Washington 98188.

PHILADELPHIA—area remails 25c. $3.—monthly. Markus, Box 34, New Britain, Pennsylvania 18901.

REMAILS from Canada's Pleasure Island. Confidential Reliable Inexpensive. Kibi, Box 254, Victoria, B.C.

69 CONTESTS

SAMPLE "Sweepstakes Bulletin" 25c. Benro Enterprises, Box 6656PS, Philadelphia, Pennsylvania 19149.

70 AUTHOR'S SERVICE

PUBLISH your book! Join our successful authors: All subjects invited. Send for free appraisal and detailed booklet. Carlton Press (Dept. PSG), 84 Fifth Avenue, New York 10011.

WANT Your Book Published? Learn how we publish, advertise, promote, distribute. Many successes. Free booklet PS. Vantage, 516 W. 34th, N.Y. 10001.

71 FOR VETERANS

LEARN Cartooning at home. NO COST to veterans. Write, Cartooning, Box 7069VG, Colorado Springs, Colorado 80907.

72 EDUCATION & INSTRUCTION

COMPLETE Your High School at home in spare time. Texts furnished. No classes. Diploma. Our 75th Year. Free Brochure. American School, Dept. XB46, Drexel at 58th, Chicago, 60637.

UNLOCK Your Future. Become professional Locksmith by spare time home study. Make up to $6 per hour. All tools, equipment, incl. Facts Free. Send name, Locksmithing Inst., Dept. 1311-072, Little Falls, New Jersey 07424.

LEARN To Fix Typewriters. Desperate shortage trained men. Hundreds needed. Make up to $25 in one hour. Learn at home in spare time. Industry Approved course. Facts free. Send name, Typewriter Repair School, Dept. 3311-072, Little Falls, New Jersey 07424.

PERFECT husband-wife business. Learn Upholstery at home. Make $10 in an hour. Buy-repair-sell for even bigger profits. Kits, tool, included. Free Booklet. Upholstery & Decorating School, Dept. 5311-072, Little Falls, New Jersey 07424.

USED Courses! Books. Catalog 10¢. (Courses Bought). Lee Mountain, Pisgah, Alabama 35765.

SEWING Machine Repairing. Unique instructions. Lucrative profits. Diploma awarded. Gresslin Correspondence School, Box 927, Spencer, Iowa 51301.

MEN, Women break barrier now. Earn $9,000-$20,000 annually. Automobile Sales Industry needs thousands. Free Aptitude Test, Job Assistance. FVASS, Box 628C, Botsford, Connecticut 06404.

MAIL Order and Imports—Complete Course $2.00. P. Johnson, Box 134, Broadview, Illinois 60153.

OPERATE Collection Agency. "Little Gold Mine!" Franklin Credit, Roanoke, Virginia 24004.

LIFETIME ordination. Doctor of Divinity, church charters. Details 25¢. Life Science Church, 2207 Cardinal, Rolling Meadows, Illinois 60008.

FREE Bible Course! Degree! Request information! 708 Bragg, Monroe, North Carolina 28110.

PENMANSHIP Corrector. Improve poor penmanship quickly. Details free. Ozment, Box 2344-35, St. Louis, Missouri 63114.

USED Courses! Books! List 10c. Smith's, 124 Marlborough, Salem, Massachusetts 01970.

DEGREES Without Residence Requirements! Comprehensive Tutorships. Catalog: $3. UNITED STATES UNIVERSITY OF AMERICA, Box 5171-PS, Clearwater, Florida 33518.

FINGERPRINTING — Investigation. Exciting, secure career. Learn at home. Free book. State age . . . Institute of Applied Science, 1920 Sunnyside, Dept. 337, Chicago, Illinois 60640.

GET A British Diploma in Color. Philosophy, Biochemistry, Radionics, Homeopathy. 35 courses. Curricular free Dept. PSM, Braintridge Forest School, "Highfield" Dane Hill Haywards Heath, Sussex, England.

LEARN Auctioneering. Free Catalog. Reisch Auction College, Mason City 3, Iowa 50401.

EXTENSION and Post Graduate Awards in Philosophy, Arts, Sciences, Botanic Medicine, Homeopathy and others. 25 subjects. Curricular free. Airmailed $1.00 (refundable). Registrar, Sussex College of Technology, Highfield, Dane Hill, Sussex, England.

ELECTROENCEPHALOPHONE. Brainwave feedback instrument. Meditation. Creativity. J&J, 24120-S 3PW, Bothell, Washington 98011.

HIGHLY Effective Specialized Home Study Courses. Fast, inexpensive and Complete. Many Categories: Electrical, Electronics, Mechanical, Building Trades, Etc. Diplomas Awarded. Our 27th Year. Free Literature. CIEE, Dept. 30, Box 10634, Jackson, Mississippi 39209.

EARN Electronics Degree, mainly by correspondence. G.I. Bill approved. Free catalog. Grantham, 1503 N. Western, Hollywood, California 90027.

LEARN TO WELD—Arc, Pipe, Gas, TIG, MIG, Plasma. Free Bulletin. Write, phone or visit. Approved Ohio No. 70-12-0064-HT. HOBART SCHOOL OF WELDING TECHNOLOGY, BOX 72, TROY, OHIO 45373.

WATCH Repair. Complete home training. Diploma awarded. Free sample lesson. Chicago School, Dept. WG, Fox River Grove, Illinois 60021.

PIANO Tuning quickly learned with home study course. Diploma granted. American Tuning School, Gilroy, California 95020.

JOIN with thousands. Free Courses by Mail in the Torah or Confraternity New Testament. Please state your religion. Lamplight Studies, Box 88E, Brooklyn, New York 11229.

HIGHLY Effective Home study courses in Electronics Engineering Technology and Electronics Engineering Mathematics. Earn your Degree. Write for Free Descriptive Literature. Cook's Institute of Electronics Engineering, (Dept. 11), P.O. Box 10634, Jackson, Mississippi 39209. (Established 1945.)

GAME Warden, Government Hunter, Forestry, Park & Wildlife Service announce job openings regularly. Prepare at home for outdoor work, good pay, security. Approved for Veterans! Complete information Free! Write North American School of Conservation—PS, —Newport Beach, California 92663.

DEVELOP Mind Power, personality, memory while asleep! Free details. SLRA, Box 24-SF, Olympia, Washington.

VETERINARY Assistant — Train at home for exciting animal care career. Send for Free "Career Kit." North American School of Animal Sciences, PS, Newport Beach, California 92663.

COLLEGE Degree at home. Choice of subjects including Law. Easy tuition. Williams College, 445 East Second South, Salt Lake City, Utah 84111.

73 CARTOONING, SIGN PAINTING

MODERN Cartooning taught by mail. Write for free brochure. Cartoonerama, Box 263-4I, Branford, Conn. 06405.

LEARN Cartooning at home. V.A. Approved. Write: Cartooning, Box 7069G, Colorado Springs, Colorado 80907.

"HOW TO MAKE MONEY WITH SIMPLE CARTOONS" — Informative book sent FREE tells way to big income. Cartoonists' Exchange, 197, Pleasant Hill, Ohio 45359.

SIGN Painting—$1000 per month part-time. Free catalogue. Kaufmann Supply, Centertown, Missouri 65023.

CARTOON for money! ! ! Free Book: Success. Box 885B, Dearborn, Michigan 48121.

74 ART INSTRUCTION

COMMERCIAL Art Instruction Low Rates. Box 323, Dedham, Massachusetts 02026.

76 DETECTIVES

LATEST Snooping Countermeasures Manual $10.00. Negeye, Box 1036, Anderson, Indiana 46015.

DETECTIVE Profession, easy home study; free tie-tack or lapel pin, certificate, future. GI approved. Professional Investigators, Box 41345, Dept. CB, Los Angeles, California 90041.

EXCITING Profession. Easy Home-study Course; Diploma. GI Approved. Universal Detectives, Box 8180-E, Universal City, California 91608.

77 LOANS BY MAIL

PAY Bills! Borrow to $1500 by mail! Convenient terms! State licensed. Postal Finance, 6018 Military Avenue, Dept. 11-N, Omaha, Nebraska 68104.

79 BUY IT WHOLESALE

BUY BELOW WHOLESALE! Thousands of name-brand items at factory prices plus small service charge! Directly thru us. Free details! American Buyer's P.O. Box 848S, Buffalo, N. Y. 14240.

HEARING Aids. Batteries. Wholesale. Catalog 25c. Fiston, Box 144E, New Preston, Connecticut 06777.

165 FREE Wholesale catalogs! Unbeatable bargains. Mailorder drop shippers. Automobile discounts. Free details. Vault International, Box 7284S, Lexington, Kentucky 40502.

800,000 BARGAINS! Closeouts. Imports. Surplus. Free details! Wholesalers, 1265-PF Broadway, New York, New York 10001.

Copyrighted material

WORLD'S Largest wholesale supply. Buy from 7853 American. European. Japanese wholesalers. Hongkong tailor-made clothes. 123 dropship catalogs. Rockbottom prices. Automobiles. Free details. International Buyers. Box 16386-PS, Portland. Oregon 97233.

FREE Wholesale Catalog. Lure parts. Molds. Rod Blanks. Reels. Archery. Metal Detectors. Rare Hardwoods. Finnysports. (PE). Toledo. Ohio 43614.

UNIQUE wholesale club! ! Save on thousands of famous brands: jewelry. tools. appliances. stereos. etc. 40-50% off retail; same wholesale prices retailers pay! Purchase for yourself or resell for fantastic profits. Free information. Homestead. Dept. 42G. 18 Westcliff Drive. Mount Sinai. New York 11766.

BARGAINS Buy Wholesale and Below! Name Brands. Appliances. Furniture. Sports. Equipment. Televisions. Cameras. Watches. Jewelry. Thousands More. Huge Discounts to $1.000 on New Automobiles. All Makes. Free Details. Write Today; Worldwide Bargainhunters. Box 730-B. Holland. Michigan.

80 ADVERTISING AGENCIES & SERVICES

FREE expert assistance for mailorder advertisers. Ratebook leading newspapers. magazine 25c. Chicago Advertising Agency. 28 E. Jackson. Chicago. 60604.

81 BUSINESS SERVICES, INFORMATION, MAILING LISTS

ADVERTISING Placed. where clicks. Mailing Lists $9.00. 1000 Gum labels. Circulars mailed $7.00 1000. Dxmailers. King. North Carolina 27021.

83 RUBBER STAMPS & OFFICE SUPPLIES

FREE Catalog. Rubber Stamps. Office Supplies. Rubber Stamp Specialist. Princeton. Iowa 52768.

ADDRESS Stamp 85c. Signature $2.80. Catalog. Carole. McLoude. Okla. 74851.

REGULAR $2.50 3-line Metal Pocket Stamp. $1.80. Low cost desk stamps. Free brochure. Wingerter. Box 777. Elmhurst. New York 11373.

FREE stamp catalog. 45 type styles. Fast service. low prices. Jackson's. Box 443B. Franklin Park. Illinois 60131.

84 PRINTING, MULTIGRAPHING, ETC.

1.000 GUMMED Address Labels . . . $1.00. Walts'. Box 966. South Bend. Indiana 46624.

BUSINESS Cards. Rubber Stamps. Printing. Free Literature. Jordan's. 552 West O'Connor. Lima. Ohio 45801.

PRINTING MACHINES. Offset. Mimeograph. Typewriters. Composing. Plate making Machines Dixgraph. King. North Carolina 27021.

EXCLUSIVE! Be First with Your Own Coat-Of-Arms Stationery. Free Details. Jamerson. Box 15056. 4120 Manchester. St. Louis. Missouri 63110.

85 PRINTING & RUBBER STAMP OUTFITS

LOW Priced Rubber Stamp Making Supplies. Starting Outfits. Martins. 1432 Major. Jefferson City. Missouri 65101.

PRINTING Presses. Type. Supplies. Lists. 10c. Turnbaugh Service. Mechanicsburg. Pennsylvania 17055.

SAME Day shipment on rubber stamp supplies. Revised wholesale price list No. 8 free. Star Stamp Supply. 732 Federal. Chicago. Illinois 60605.

BUSINESS Cards. Stationery. Rubber Stamps. Labels. Fliers. etc. Free sample. price list. Pioneer—PS7. Island Park. New York 11558.

SIMPLE-X RUBBER STAMP PRESSES. hydraulic operated. electrically heated. Sizes 5"x8". 8"x12". 10"x15". Starting outfits. Orders for presses. supplies shipped day received. Free catalog low supply prices. Send $1 for postage and handling (refundable on first order). Custom Manufacturing. 406-PS. East Elm. Springfield. Missouri 65801.

RUBBER Stamp Outfits. Supplies. Kiewiet. 2025 Barney Road. Kalamazoo. Michigan 49007.

RUBBER stamp manufacturers supplies. Presses. starting outfits. Best prices. service. Catalog. Jackson Supply. Box 443B. Franklin Park. Illinois 60131.

88 OLD GOLD, JEWELRY WANTED

HIGHEST CASH for Gold. Jewelry. Gold Teeth. Rings. Diamonds. Watches. Silver. Platinum. Mail Articles Today. Free gift with Information. Chicago Gold & Precious Metals. 6 E. Monroe. Dept. 1157. Chicago 60603.

CASH Immediately For Old Gold. Jewelry. Gold Teeth. Watches. Diamonds. Spectacles. Silver. Platinum. Mercury. Free information. Rose Industries. 29-Y East Madison. Chicago. 60602.

WANTED . . . Gold. Silver. Platinum (any form). Coins. Information Free. Wilmot's. 1067 Bridge. Grand Rapids. Michigan 49504.

89 WATCHES, CLOCKS—SALES & SERVICE

WATCH and clock repairing books. Free Catalog. North American. Box 77-BT. Fox River Grove. Illinois 60021.

COMPLETE Watchmakers'-Jewelers' Catalog $1.00. Snell-Bengal. 205 Helm Building. Fresno. California 93721.

USED Wrist Pocket Watches—$3.00 up. Free list. Southern Watches. 5-PS. South Wabash. Chicago 60603.

90 GIFTS

VARIETY bargains. Catalog. 20¢. Continental. 3425 North Detroit. Toledo. Ohio 43610.

FREE—Novelty and Game Catalog. Long Grove Town & Country Distributors. P.O. Box 194. Dept. xb54. Lake Zurich. Illinois 60047.

FREE CATALOG of sensational gifts and novelties. J & L Co.. 73A Main St.. New Paltz. New York 12561.

91A GOOD EATING

DELICIOUSLY Different—Guacamole. Gazpacho. black bread—Send $1. To Paco. Box 901. Brevard. North Carolina 28712.

BEEF JERKY. Make yours with these simple instructions. Free Spices Included $2.00. Jerky. Box 5382PS. High Point. North Carolina 27262.

92 MODELS—SHIPS, CARS, PLANES, ROCKETS

ROCKETS Model rocket and hobby supplies. catalog 25c. Krueger Rocket Company. 6428 S. Main Street. Downers Grove. Illinois 60515.

SHIP and Yacht model fittings; Pine construction Hull Kits; blueprints. Send 50c for Illustrated catalog. A. J. Fisher. Inc.. 1002 Etowah Avenue. Royal Oak. Michigan 48067.

SHIP Models. Kits. fittings. plans. books. tools. engines. motors. Big illustrated catalog 50c. Mass. residents add 3% tax. James Bliss & Co.. Dept. PS. Route 128. Dedham. Mass. 02026.

ROCKETS: Real flying models—flights up to 2500 ft. New illustrated catalog 25c. Single and multistage kits. cones. engines. launchers. trackers. rocket aerial cameras. technical information. Fast service. Estes Industries. Dept. 3A. Penrose. Colorado 81240.

LIVE STEAM. GASOLINE. TRACTION ENGINES. CASTINGS. "MTP" FITTINGS. TOOLS. BOOKS. numerous miscellaneous items. Revised Catalog #21. $1.50. Coles' Power Models. Ventura. California 93001.

SHIP models catalog 25c. Scientific Inc.. 340 Snyder. Berkeley Heights. New Jersey 07922.

ROCKETS!!! Giant new catalog—twelve new flying kits—engines—(safety certified)—flights over 2.600 feet. Send 25c for catalog—refunded with first order. Fast delivery. Centuri Aerospace. Dept. Q42—B. P.O. Box 1988. Phoenix. Arizona 85001.

93 ELECTRIC TRAINS, RACEWAYS

LIONEL Catalog 50c. Bulletin 10c. Old Trains Bought-Repaired. Mack Brothers. 2041 Chicago Ave.. Chicago 60622.

94 FOR INVENTORS

INVENTORS-Save unnecessary patent and marketing expenses by getting professional. independent evaluation of your ideas. inventions. Write: Invention Evaluation Services. Box 665. Marion. Ohio 43302.

INVENTORS—Do you want to sell or license your invention on cash or royalty basis? Write: Kessler Corporation. C-77-F1. Fremont. Ohio 43420.

MONTHLY information. news. analysis of invention business. Subscription $12.00. copy $1.50. Write Synthesis Magazine. Box 157-E. Manhattan Beach. California 90266.

SERVICE for inventors by inventor-engineer. M. Fabish. 675 E. Granville Road. Columbus. Ohio 43229.

PATENT Searches including Maximum speed. full airmail report and closest patent copies. Quality searches expertly administered. Complete secrecy guaranteed. Free Invention Protection forms and "Patent Information" Write Dept. 4. Washington Patent Office Search Bureau. Benjamin Franklin Substation. P.O. Box 7167. Washington. D.C. 20044.

IMMEDIATE cash. for Patent Applications. free Patent Searches. Write for details. Universal Patents. 184-B. Marion. Ohio.

PATENT Application Financing. Free Patent Search Plan. Global Patent Division. 2420 77th. Oakland. Calif. 94605.

U.S. PATENT Office Searches. 234 Broadway. Room 3615. New York. Free Invention Certificates.

FREE PAMPHLET: "Tips On Safeguarding Your Invention." Write: United States Inventors Service Company. 501-X Thirteenth Street N.W.. Washington. D.C. 20005.

PROSECUTE Your Own Patent Application. All Material. Three Booklets Including Step-By-Step Procedure—$9.50. Inventors Service. Box 3574. Washington. D.C. 20007.

INVENTORS—United States Patent Office Searches. Patent Development Engineering. marketing of inventions—ideas by Licensed Professional Engineer—Patent Engineer and United States Patent Office Former Examiner. Inventions developed for patenting and marketing. We are contacted by many manufacturers seeking to purchase appropriate new products invented by our clients. Send for Free Invention Certificates and Invention Information. Serving inventors since 1948. George Spector. Licensed Professional Engineer—Patent Engineer—3615 Woolworth Building. New York. New York 10007.

INVENTORS — ENGINEERING ASSISTANCE. You set fee. Spencer Engineering. 1134SCR288. Clyde. Ohio 43410.

PROMOTE IT YOURSELF—Complete guide for inventors. Development thru sale; Quantum Group. 1529-B Greenleaf. Evanston. Illinois 60202.

INVENTORS CLUB: Join the only nationwide club for inventors (non-profit). many free benefits. American Inventors Club. P.O. Box 1064. Richardson. Texas 75080.

95 INVENTIONS WANTED

INVENTIONS Needed immediately for manufacturers. For additional information write Kessler Corporation. C-77-IW. Fremont. Ohio 43420.

INVENTORS! ! ! 25 "No Advance Fee" Patent Brokers/Buyers $2.00. Speedline. Box 458. Woodriver. Illinois 62095.

INVENTORS! Don't sell your invention. patented or unpatented. until you receive our offer. Eagle Development Company. Dept. S. 83 Wall Street. New York 5. New York.

INVENTORS! Sell your invention for cash or royalties! Our client manufacturers eagerly seek new items. Patented. Unpatented. Financial assistance if needed. 25 Years proven performance. For free information. write Dept. 17. Gilbert Adams. Invention Broker. 81 Wall St.. New York 10005.

INVENTORS! We will sell your idea or invention. patented or unpatented. Our national manufacturer-clients are urgently seeking new items for highest outright cash sale or royalties. Financial assistance available. 10 years proven performance. For Free information write Dept. 54. Wall Street Invention Brokerage. 79 Wall Street. New York. New York 10005.

WE either sell your invention or pay cash bonus. Write for details. Universal Inventions. 298-G. Marion. Ohio.

INVENTORS—Hundreds of manufacturers have requested our assistance in locating marketable new products. Complete information free. Institute of American Inventors. Dept. 30C. 635-F Street. N.W.. Washington. D.C. 20004.

INVENTIONS wanted. Patented; unpatented. Tremendous Manufacturers lists. Global Marketing Service. 2420F 77th. Oakland. California 94605.

INVENTORS—Our factory in HONG KONG can manufacture and package your invention at unbelievable low costs. ready for the market. We are anxious to finance good commercial ideas and can provide marketing services. RS & Assoc.. Box 149G. Tustin. California 92680.

INVENTIONS Promoted—For Cash—Royalty Sales with Manufacturer Contacts. George Spector. Licensed Invention Engineer. Woolworth Building. New York 10007.

INVENTORS: Protect your ideas! Free "Recommended Procedure." Washington Inventors Service. 422-G. Washington Building. District of Columbia. 5.

INVENTORS
Manufacturers Need New Products
YOUR INVENTIONS & IDEAS DEVELOPED—PREPARED
For Cash / Royalty Sales
Design—Marketing—Patent Research
International "Link to Industry"
Second Decade of Reliable Service to
INVENTORS-MANUFACTURERS-ATTORNEYS
Member: United States Council
International Chamber of Commerce
FREE *"Invention Record" Form & "Product Marketing" Brochure*
THE RAYMOND LEE ORGANIZATION
230-J Park Avenue,
New York City 10017
Director: Former U.S. Gov't Patent Adviser

99 FOR SALE MISC.

END check book confusion! Learn how to keep your check book straight. Easy to follow instructions. $1.00. McClelland. (ID). Box 554. Poplar Bluff. Mo. 63901.

MONEYSCANNER — counterfeit currency detection. Details: Auda-Kng. 522 Shore Road. Long Beach. N.Y. 11561.

100 WANTED TO BUY

QUICKSILVER. platinum. silver. gold. Ores analyzed. Mercury Terminal. Norwood. Massachusetts 02062.

102 TREASURE FINDERS & GEIGER COUNTERS

TREASURE Finder—$9.95 Postpaid. Complete. Green's Detector's. Route 1. Bloomington. Illinois 61701.

TREASURE Map Of Florida—includes treasure description. approximate location. Millions in treasures still unfound. $5.00. M.B3 Enterprises. Box 1941. Cincinnati. Ohio 45201.

TRANSISTORIZED detectors—$19.95 to $79.95. Family fun and fortune. Catalog write Treasureprobe PB21. Tennent. New Jersey 07763.

POWERFUL Metrotech Locators Detect Gold. Silver. Coins. Relics. Moneyback Guarantee. Terms. Free Information. Underground Explorations. Dept. D. Box 793. Menlo Park. Cal. 94205.

FISHER DETECTORS. You deserve the best! Free literature. FRL. Dept. PS19. P.O. Box 490. Belmont. California 94002.

TREASURE Hunters! Prospectors! Rockhounds! Hobbyist! Find gold. silver. relics with world famous Detectron Metal Detectors. Free information. Delivery immediate. Detectron. Dept. 7-PS. Box 243. San Gabriel. California 91778.

FIND buried treasure with revolutionary patented. analytical metal detector. Features push button and automatic tuning. negligible ground pickup. greatest range. Free catalogue. Gardiner Electronics. Dept. 1-4729 N. 7th Avenue. Phoenix. Arizona 85013.

GOLDAK Treasure Locators—Pleasure and profit in a hobby you'll enjoy. Find coins. relics. gold. silver. Charge on Bankamericard. GOLDAK. Dept. PS. 1101-A. Air Way. Glendale. Ca. 91201.

TREASURE Hunter's Dream—Find Relics. Coins. Gold And Metal With Our Spaceage Metal Detector. Plans $3.00. Kit $13.75. Assembled $24.95. Marco. P.O. Box 5265. Huntsville. Ala. 35805.

TREASURE Hunters! Prospectors! Relco's new instruments detect buried gold. silver. coins. minerals. historical relics. Transistorized. Weighs 3 pounds. $19.95 up. Free catalog. Relco-A41. Box 10839. Houston. Texas 77018.

Copyrighted material

SEARCH Treasure Finders. Locate Gold. Silver. Coins. Relics. Operate Underwater. Money Back Guarantee! Free Information. Search Electronics. Box 8396P. St. Petersburg. Florida 33738.

FREE—Valuable Treasure Finder catalog sent by return mail. Find Coins. Rings. Gold. Silver. Metals. Relics. Write today. Jetco. Dept. CPS. Box 26669. El Paso. Texas 79926.

TREASURES. VALUABLE COINS. GOLD. SILVER. jewelry. and relics easily found with White's metal-mineral detectors. designed especially for the prospector and Treasure Hunter. YOU CAN NOT BUY BETTER INSTRUMENTS AT ANY PRICE! BUILDER OF THE WORLD'S LARGEST LINE of mineral and metal detectors. also Geiger and Scintillator Counters. Ultra Violet Lights. Electronic Magnetometers and magnetic meters. Free catalog: White's Electronics. Inc.. Room 361. Sweet Home. Oregon 97386.

103 OF INTEREST TO WOMEN

WOMEN Neewed to fill out income tax forms at home. We show you how. Simple. easy to learn. $700 per month earnings possible. Details Mailed free. No salesmen. Hurry! Federated Tax Service. 2019 Montrose. Chicago 60618.

SAVE Dollar$ On Grocery Bills!! Free Information . . . May's. Box 802-S. Natchez. Mississippi 39120.

$100 WEEKLY Possible addressing mailing. Spare time. Free details. Send self-addressed stamped envelope. Newby Publications. Box 20427PS. San Antonio. Texas 78220.

HOMEWORKERS! $100.00 weekly addressing for firms. Begin immediately. Details—send stamped. addressed envelope. Hamilton. 272-TP7. Brooklyn 11235.

GUARANTEED. $20.00 Every 80 Envelopes you stuff. No postage. addressing required. Information send 30¢ with stamped self-addressed envelope. Economy 629-DB Franklin. Clearwater. Florida 33517.

HOW to Make Money Writing Short Paragraphs. Information Free. Barrett. Dept. C-86-K3. 6216 N. Clark. Chicago. 60660.

$500 MONTHLY Possible addressing—stuffing envelopes (longhand—typing) at home. $500 Monthly Clipping news items from your newspaper. Information: Send stamped self-addressed envelope. American. Excelsior Springs. Missouri 64024.

$350 FOR Your Child's Photo for our advertisements. All ages. Rush small photo. mother's. child's name. Spotlite. PS66. 140 N. LaBrea. Hollywood. California 90036.

BE ORGANIZED
IF You save your copies of Popular Science. here's a great way to keep them from getting torn. dirty. etc. Heavy. quality-constructed file boxes hold a year's issues (new. large size format). Gold embossed. Only $4.25 each. postpaid. Order today from Jesse Jones Box Corp.. P. O. Box 5120. Philadelphia. Pa. 19141.

104 RESORTS & TRAVEL

TRAVEL free to any place in America. Secret saves thousands. Manual $4.95. Athey. Tarentum. Pennsylvania 15084.

TRAVEL Agents Make $$$$$. Exciting. Booming Careers! Easy Home-Study Plan. Approved for Veterans. Free! "Travel Career Kit." Write—North American School of Travel. PS. Newport. California 92663.

105 MISCELLANEOUS

MAGNETS. All Types. Specials-20 disc magnets. or 2 stick magnets. or 10 small bar magnets. or 8 assorted magnets. $1.00. Maryland Magnet Company. Box 192-B. Randallstown. Maryland 21133.

WINEMAKING beginners kit $2.00. Carpenter. Box 46. New Milford. New Jersey 07646.

FANTASTIC Invention—Follow Unbelievable Instructions. 60 Seconds later. Lifesize Oil Portraits of Anyone or Double your Money Back! Only $3.98: Jiffy Portrait. 1315 Ronan. Wilmington. California 90744.

TRUE Bible Plan of Salvation Tract form send stamped self-addressed envelope to Paul Karr. 2175 No. Leader St.. Decatur. Ill. 62526. Offering appreciated.

WINEMAKERS: Free catalog. Fast Service. Arbolyn. Box 663. West Columbia. South Carolina 29169.

U.S. $1000 BILLS!! Obsolete Replicas 5/$4. Genuine Quarter—Heads on both sides $3.95. National. Box 1391P. Clearwater. Florida 33517.

Books on Antiques and their Prices. Free Circular! Period Books. Uniontown. Pennsylvania 15401.

SURPRISE that someone you know who always says. "I'll do it when I get around to it." Give him or her a novel genuine ROUND TUIT. Only $1.00 each. 3 for $2.50. D & L Products. Box 183. Irwin. Pennsylvania 15642.

AUTHENTIC Scale Model Ornamental Windmills. Colored Brochure 25c Refundable. Macks. Box 377. Aurora. Illinois 60507.

WINEMAKERS Yeast. Recipes. Catalog 25c. Kraus. Box 451N. Nevada. Missouri 64772.

WINEMAKERS catalog—free. Bacchanalia. 273 Riverside Ave.. Westport. Connecticut 06880.

IDENTIFICATION CARDS. SEND stamped self-addressed envelope for samples. ECSP. P.O. Box 12117. Las Vegas. Nevada 89112.

DON'T Die without a will! Blank Will form. Instructions. protects your family. Only $1—guaranteed! Order today!! Campbell. Dept. 1PS7. 2079 Woodbourne Ave.. Baltimore 21239.

WINEMAKERS. . . . Free Illustrated Supply Catalog of yeasts. Equipment. Recipes. Continental. Box 18223PS. Indianapolis. Indiana 46218.

TEN Colorful Postcards Dollar Postpaid. Ramirez. Apartado Postal 1-4040. Guadalajara. Jalisco. Mexico.

WINEMAKERS Special! ! ! Fermentation Locks 3/$1.00. Illustrated Catalog. $5.00 Credit Coupon Free. Werth Wine. Box 1902EA. Cedar Rapids. Iowa 52406.

FREE BOOK. Prophet Elijah Coming Before Christ. Megiddo Mission. Dept. 58. 481 Thurston Road. Rochester. New York 14819.

WINEMAKERS: Free illustrated catalog of yeasts. equipment. Semplex. Box 12276. Minneapolis. Minnesota 55412.

BUILDING MIND POWER—Free Information—CARLILE. Box 26. Reisterstown. Maryland 21136.

WINEMAKERS: Free recipes. catalog. Texas Winecrafters. Box 4424. Wichita Falls. Texas 76308.

INEXPENSIVE Swiss-made electric shavers and massagers. Guaranteed. Details. Dept. P2823. Box 81. Ste Anne de Bellevue. Quebec.

BURGLAR FIRE
PARTS • KITS • SUPPLIES
ALARM INSTALLERS' SUPPLY HOUSE
WHOLESALE PRICES - INSTALL YOURSELF
SEND 50¢ FOR CATALOG & INSTALLATION GUIDE
ALARM INSTALLERS SUPPLY HOUSE
SUITE - A 50 Rose Place, Garden City Park
N. Y. 11040
ALARM

WINEMAKING
the fun hobby you can drink
Kit $4.98
• Saccharometer • Yeast Nutrient
• Instruction book • Air Lock
• Siphon • Chemicals (3)
• Imported Wine Yeast
Free catalog & Recipes
JIM DANDY WINE SUPPLIES
BOX 30230·N CINCINNATI, O. 45230

HOMEWINE
And brew supplies and ingredients, recipes for year round wine-making. It's a fascinating hobby.
SEND FOR FREE CATALOG
Malt Extracts — Bavarian Yeast — Bottle Caps Capper — Hydrometers — Hops — Wine Yeast Chemicals — Clarifying Aids — Air Locks — Saccharometers — Syphons — Corks — Champagne Corks — Screw Caps — Fruit Juice Concentrates — Fermenting Vessels — Presses — Barrels — Cooper Goods — Wine Kits
DANENBERGER'S BOX 276-S
NEW BERLIN, ILLINOIS 62670

CANNED SOUND
Pocket-Sized Horn Blasts a Mile
The world's loudest small horn. Powered by a replaceable Freon cartridge which gives a hundred blasts or more. Keep in pocket or handbag for personel protection alarm. Use as a boat. bicycle or motorcycle horn. for hiking. camping or for cheering your team. Weight 3 oz. **911 Horn Complete $3.00. 911-2R Refill Cartridges 2/pkg. $2.60.**
Postpaid—Satisfaction Guaranteed
DOORN SALES Dept. 1A7
6019 West 28th St.. Cicero. Illinois 60650

BE ORGANIZED
IF You save your copies of Popular Science. here's a great way to keep them from getting torn. dirty. etc. Heavy. quality-constructed file boxes hold a year's issues (new. large size format). Gold embossed. Only $4.25 each. postpaid. Order today from Jesse Jones Box Corp.. P. O. Box 5120. Philadelphia. Pa. 19141.

NEARSIGHTED? FARSIGHTED?
No more glasses to wear! Latest discoveries! Eye training course will improve your vision. Are your eyes worth $3.95? Mail cheque to:
SEE-WELL COMPANY, Box 1010-PS7
Postal Station "A" Toronto 1, Ont., Canada
GUARANTEE: Results within ten days or your money back.

All-Purpose Light

Clips easily to any 12-volt battery. Complete with 25-ft. safety cord, and 12-volt, 2,000-hour, 50-watt bulb. **$6.95 postpaid.**
LUMSDEN & ASSOCIATES
330 Pleasant St., Petaluma, Calif. 94952

SAVE YOUR COPIES OF POPULAR SCIENCE

Keep them neat and in good order for future reference by ordering these handsome, custom-made library cases. They'll look good in your library or your workshop. Each case holds a full year's issues. Richly covered in black leatherette, its royal blue spine is decorated in gold leaf with the year and the Popular Science insignia.

They're only $4.25 each, or 3 for $12 postpaid. To order, send check or money order to Jesse Jones Box Corp., P. O. Box 5120, Philadelphia, Pa. 19141.

106 PERSONAL

WIPE Out Debts. Get $600 to $25.000 relief. Easy loans. Free details. Counselor-16. Kerrville. Texas 78028.

HOW Much does being your own boss or making $25.000.00 per year interest you? The Warner breakthrough in the Engraving field could be your future. Write: Warner. Room EC-3-BK. 1512 Jarvis. Chicago. Illinois 60626.

CONFIDENCE, power and good first impressions can return handsome dividends. 164 page book tells how to get people to say "yes". socially and in business. $2.25. World of Wares. Box 166. Patricia Ln.. Lake Grove. New York 11755.

TATTOO REMOVING
WITH Chemical Do-It-Yourself Method. No Needles. Free Information: Atlanta Company. 907B Beachpoint. Pickering. Ontario.

"RULE Others with Thoughts." (Telepathy) Write: Clarion. Box 1769-S6. Chicago 60690.

LOSING Hair? Balding? Dandruff? Free copyrighted booklet. Dr. Shiffer Laboratories. Dept. 533. Box 498. Punta Gorda. Florida 33950.

THIEFPROOF your car. Easily installed with simple instructions. Send $1.00. Box 345. Victoria. BC. Canada.

DON'T DIE without a will! 4 blank will forms and informative booklet only $1.50. Don't delay. Panama House. Dept. 21. Rt. 2. Box 507-D. Panama City. Florida 32401.

HOW INTELLIGENT are you? Self-scoring test reveals I.Q. in 45 minutes! Send $2. today—guaranteed!! Panama House. Dept. 21. Rt. 2. Box 507-D. Panama City. Florida 32401.

INVESTIGATORS. Latest Electronic Aids. Free Literature. Clifton. 11500F NW 7th Ave.. Miami. Florida 33168.

A COMING Whirlwind to sweep this earth! Free Information! Write: Harvest PS. Jefferson City. Missouri 65101.

THINK! DO YOUR THING BETTER!
MONEY. Job. Love. Health. Sports. Mailorder. Recreation. Whatever—Last Edition. Physo-Cybernetics. Do your thing better after reading or money back. $2.00 plus 25c for mailing. "Think" Books. 17600 Community Street. Northridge. California 91324.

RECORD Telephone Conversations Privately - Automatically. Leave Recorder Unattended. Robert's. Box 49PS1. Parkridge. Illinois 60068.

RUPTURED. Relief and Comfort. No Understraps. Elastic or Steel. Write Hand Lock Products. Preston 2. Ontario. Canada.

FREE book—all about wills—with each order for binding will form. $2.00. Consumer Services. 202 St. Lo. Department 1A7. Fort Ord. California 93941.

SAUNASHAVE: Patent Pending. Facial Sauna melts whiskers in 15 seconds. Smoothest. most comfortable shaves ever! Halves shaving time—Doubles blade life! Lasts for years—Satisfaction guaranteed. Lifetime of shaving pleasure: only $2.00 ppd.! Sauna Mfg.. Box 7000SP. Manchester. Vermont 05254.

OVERSEAS Jobs — Europe. South America. Australia. Far East. etc. 2000 openings all trades. Construction. Office. Engineering. Sales. etc. $700 to $3.000 month. Expenses paid. Free Information. Write: Overseas Jobs. International Airport. Box 536-P. Miami. Florida 33146.

CASH LOANS by mail! Up to $2.500 on signature alone. No Collateral! Secret! Union Finance Company. 3608 No. 16th Street. Dept. PS. Phoenix. Arizona 85011.

4 WILL Forms. Attorney's Instructions. Guaranteed!! $2.00. Dept. 1P17. Wayman House. 2024 Orchard. Orange. California 92668.

STOP NOISE: SAW·MOTOR·KID·HI-FI·ETC.
PROTECT YOUR PRECIOUS HEARING
DISPOSABLE EARPLUGS
Comfortable. 43db drop. Always clean. Specially designed synthetic fibre material.
$1.25 enough for 6 sets $2.00 enough for 12 sets
DALAR 172 N. MAIN ST., FAIRPORT, N.Y. 14450

Get your bills

WE CAN HELP YOU!
We are not a loan company, so poor credit is no problem! **(Maximum total debt accepted is $20,000.)**
Send your name and address. We'll mail more information and a CONFIDENTIAL application.
UNITED SECURITY CORPORATION
Dep't. PS-7, 36 Kennedy Pl., Providence, R.I. 02903

107 HEARING AIDS

IMPROVE Your Hearing. Information Absolutely Free. Rhodes. Box 518PS. Paducah. Kentucky 42001.

HEARING aids—Huge savings on tiny. all in the ear. eyeglass. behind the ear and body models. Free home trial. Low as $10 monthly. Write for free catalog. Prestige. Dept. R-7. Box 10947. Houston. Texas 77018.

HUGE SAVINGS. Eliminate dealer markups. Free Trial. Batteries wholesale. Terms Arranged. Lloyds-PSC. Rockford. Illinois 61108.

Copyrighted material

If you've ever said...

"There must be a better way to earn a living..."

one of our free Career Guidance Booklets may provide the opportunity you've been looking for.

It happens to all of us, sooner or later. No matter what kind of job we have.

One day, it suddenly strikes home that—like it or not—we're going to have to work for a living, the rest of our lives. And most of us are horrified at the thought of forever being locked into the jobs we now hold.

"Surely," we tell ourselves, "there must be a way to earn enough extra dollars each month to balance the family budget. Surely, there must be a way to get the kind of position where you don't have to worry about job security. Surely, there must be a way to get a job that offers greater opportunity for advancement, and more job satisfaction."

"Surely," in other words, "there must be a better way to earn a living!"

If you, too, have been thinking these thoughts lately, you'll find one of our free Career Guidance Booklets very helpful at this time. We invite you to send for one.

Your free booklet will describe the opportunities for higher income and greater job security you might

expect in one of the career fields listed on the coupon below. It will also explain why ICS can prepare you for this new career field... right in your own home...in your spare time...*regardless of your education or past experience.*

In addition, you will receive a free "Demonstration Lesson" that lets you see for yourself why preparing for a more rewarding career —the ICS way—may be a lot easier than you think.

Please bear in mind, as you check off your career choice on the coupon below, that ICS has a long and distinguished record of success as a career training organization. In fact, more than 8,500,000 men and women have turned to ICS for career training, since 1891.

ICS has provided training programs for various divisions and branches of companies like Ford; U.S. Steel; Chrysler; Mobil; DuPont; etc.

ICS Career Training is approved for Veterans and Servicemen under the new G.I. Bill, and is Accredited by the Accrediting Commission of the National Home Study Council.

In short, ICS training methods are valued and respected not only by ICS graduates...but also by leaders in Business, Industry, Government, and Education.

Now it's your turn to discover how ICS training can start *you* in a rewarding new profession. Just fill in the coupon below and mail it today for your free Career Guidance Booklet and free "Demonstration Lesson."

Keep this certificate when you mail the coupon for your free Career Guidance Booklet and "Demonstration Lesson"

This certificate symbolizes the long and distinguished record of success that ICS has enjoyed as a Career Training Institute. It is your assurance that ICS stands ready to serve you, just as it is serving individuals, business and industry of the world.

ICS Scranton, Pennsylvania 18515

Please send me a free Career Guidance Booklet, and a free "Demonstration Lesson" for the field I have checked. I understand I am under no obligation.

- ☐ Accounting
- ☐ Automotive Mechanics
- ☐ Business Management
- ☐ CATV/MATV Electronics Specialist
- ☐ Computer Programming
- ☐ Computer Servicing
- ☐ Communications/ Broadcasting/Electronics Specialist
- ☐ Drafting
- ☐ Apartment/Community Management
- ☐ Electrician
- ☐ Electronics
- ☐ Engineering
- ☐ FCC Licensing
- ☐ Hotel/Motel Management
- ☐ Income Tax Specialist
- ☐ Interior Decorating and Design
- ☐ Production Management
- ☐ Restaurant/Club Management
- ☐ TV Repair and Servicing
- ☐ High School Division (For students who want to earn a High School Diploma.)

Name _____

Address _____ Apt. no. _____

City _____ State _____ Zip _____

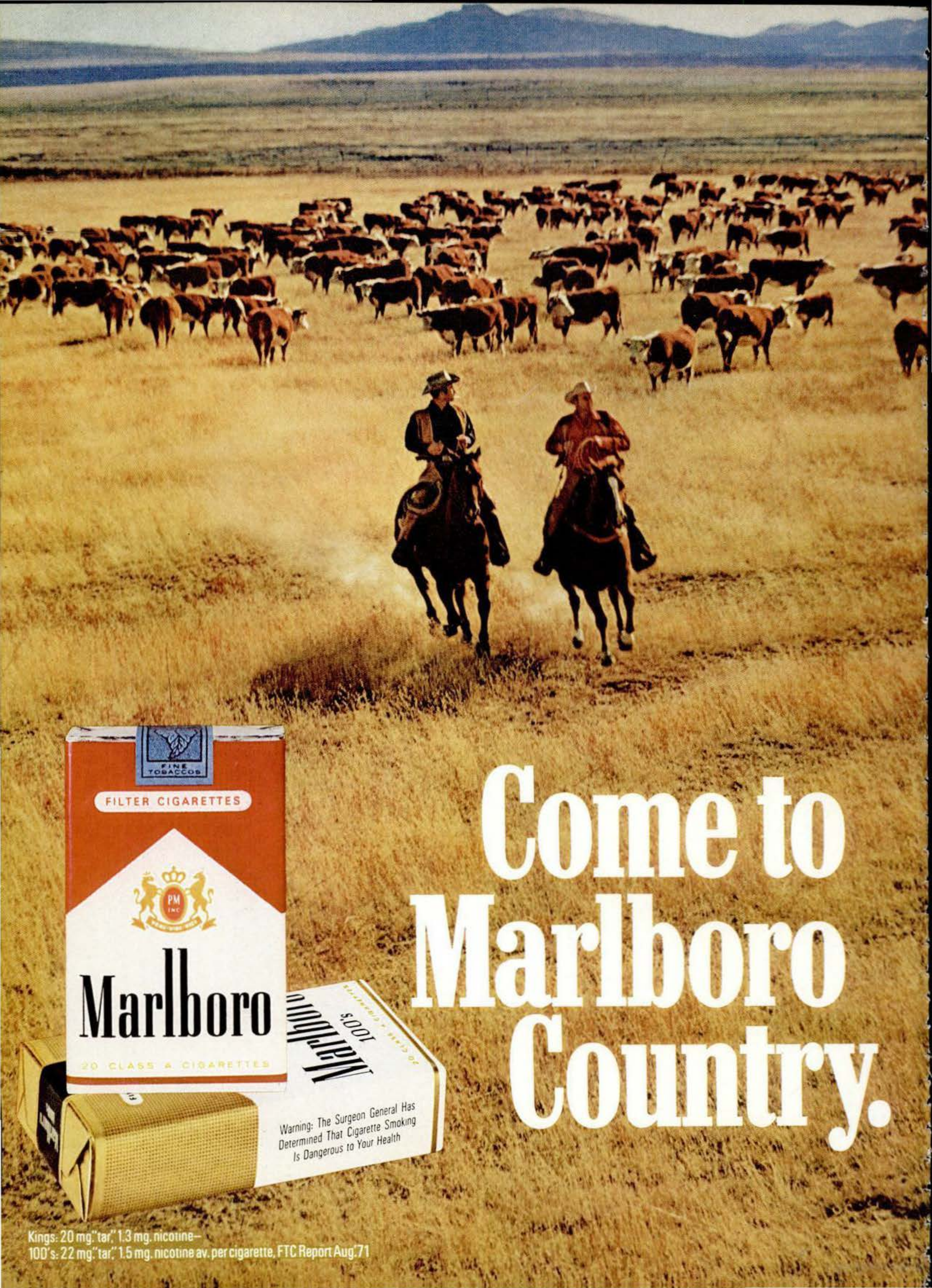
RA 326X

ICS Career Training is: Approved for veterans under the new GI BILL/Approved for federally insured loans
Accredited by the Accrediting Commission of the National Home Study Council

Copyrighted material

Whatever you drive, wherever you go, Pennzoil is worth asking for.

Copyrighted material


Come to
Marlboro
Country.
FINE TOBACCOS
FILTER CIGARETTES
PM INC
Marlboro
20 CLASS A CIGARETTES
Marlboro
100's
Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health
Kings: 20 mg."tar," 1.3 mg. nicotine—
100's: 22 mg."tar," 1.5 mg. nicotine av. per cigarette, FTC Report Aug.'71